Welch Allyn®
Kreativ®

Mach 5.0 and Mach 5.0 PLUS Air Abrasion Units

SERVICE MANUAL

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990204 Rev. A

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1. General Information

1.1 Purpose of Manual

This manual has been prepared to provide information regarding the installation, operation, maintenance, and troubleshooting of the Kreativ Mach 5.0 and Mach 5.0 Plus air abrasion equipment.

This manual has been written in narrative form supplemented with schematics and drawings for clarification. Most procedures mentioned in this manual can be performed by a factory trained representative or the user if properly instructed. Any exceptions will be clearly identified by a qualifying statement.

Words in bold capital letters are used to identify labels on the device and key safety or qualifying statements.

1.2 Safety Summary

1.2.1 Read This Manual

Prior to operating or servicing the Mach 5.0 or Mach 5.0 Plus, this manual must be read and understood. If something is not clear, call the factory for assistance before proceeding. Keep this and other associated manuals for future reference.

1.2.2 Use Proper Power Connections

Use proper wiring and connection methods to satisfy appropriate electrical codes.

1.2.3 Do Not Remove Covers Or Panels

To avoid electrical shock hazard, do not remove covers or panels when power is supplied to the unit. Do not operate the device when the covers or panels are removed.

1.2.4 Shock Hazard

Connect the Mach 5.0 and Mach 5.0 Plus to a properly grounded outlet in accordance with the National Electrical Code. **WARNING:** Do not under any circumstance remove the ground wire or the ground prong from any power plug. Do not use extension cords with the Mach 5.0 and Mach 5.0 Plus equipment.

1.2.5 Device Labeling

Do not under any circumstances remove any CAUTION, WARNING, or other descriptive labels from the devices.

1.2.6 Other Safety Statements

Other safety statements are included within the manual text and are identified as follows:

- **CAUTION:** Caution statements identify conditions or practices that could result in equipment or property damage.

- **WARNING:** Warning statements identify conditions or practices that could result in personal injury or loss of life.

1.3 Applications

The Mach 5.0 and Mach 5.0 Plus is designed for simple, reliable, and efficient operation with minimal maintenance. The Kreativ Mach 5.0 and Mach 5.0 Plus systems are designed to deliver a controlled flow of abrasive powder and air mixture through a very precise nozzle. Applications include amalgam removal, cutting, abrading, deburring, peening, and etching of tooth structures and other materials.

1.4 Contraindications

Kreativ Air Abrasion products are designed for use by and on the order of a dentist. Furthermore, Kreativ products are not intended to be used outside the device's specifications or limitations. Results are not guaranteed or warranted if other than approved (Kreativ, Inc.) disposable products are used.

1.5 Environmental Considerations

Prior to the installation of the Mach 5.0 and Mach 5.0 Plus air abrasion unit, it will be necessary to provide utilities and create an environment suitable for the trouble-free operation of the equipment.

1.5.1 POWER

All components operate on 120 VAC (220 VAC International), single phase power. Histories of power failure, power surges, and low line voltages should be noted and reported to the factory or the service representative as these conditions may create adverse conditions for the operation of the equipment. The use of surge protectors is recommended when possible.

1.5.2 AIR

The Mach 5.0 air abrasion unit requires input air pressure at a minimum of 80 PSI and a maximum of 130 PSI. Air pressure can be delivered to the Mach 5.0 via a main office air compressor, a compact portable compressor, or compressed nitrogen. The Mach 5.0 air abrasion unit is equipped with an internal pressure sensor to help the user identify when Low Air conditions arise.

The digital remote control will illuminate the error code Low Air if the user has selected an air pressure (Particle Energy) higher than the available input air source. The unit will not operate until the user selects a lower air pressure. When the user has selected the available input air requirement, the Low Air error code will clear from the remote control and the user will be able to resume normal operation.

1.5.3 Main Office Compressor

The main office compressor should be sized to deliver 80-130 PSI of constant, clean air pressure to the Mach 5.0 unit. The Mach 5.0 unit is equipped with an internal Ambient Dryer and Coalescing Filter which ensures a clean and dry air supply stream. Under extreme environmental humid conditions an additional dryer is recommended to be installed on the air line between the compressor and Operatory Regulator. This will ensure extra protection to the Mach 5.0 unit. If the operatory does not have the minimum air input requirement, the Mach 5.0 will not perform to the desired specification level and the customer should be informed that auxiliary air supply may be required.

1.5.4 Compact Portable Compressor

Kreativ offers a portable compressor system to use with the Mach 5.0 unit when adequate air pressure is unattainable from the main office compressor. The Kreativ compressor is equipped with an ambient dryer to ensure a clean and dry air supply stream. If the user does not want to invest in two separate systems for air abrasion processes, the

customer should be informed that Kreativ offers a Mach 5.0 Plus unit which is equipped with an internal air compressor.

1.5.5 Compressed Nitrogen

Compressed nitrogen can be used to supply the air pressure for the Mach 5.0 unit. There are variously sized tanks available from most local gas companies. The regulator on the nitrogen tank should not exceed 130 PSI.

2. Theory of Operation

2.1 Introduction

The Mach 5.0 and Mach 5.0 Plus are air abrasion systems. An internal or external air supply is required to mix abrasive powder and air in a pressurized chamber, which then moves through the nozzle tip of the handpiece. The unit includes pre-filtration to remove particulate matter before the point-of-use site. The Remote Control provides a means of managing the required air pressure and powder flow.

2.2 Connections Mach 5.0 and Mach 5.0 Plus (Refer to Figure 1)

2.2.1 ON/OFF Power Switch

The power switch is located on the back lower panel of the Mach 5.0 and Mach 5.0 Plus. The switch turns the unit ON or OFF.

2.2.2 Power Cord Connector

The power cord connector is the connection point for the power cord.

2.2.3 Fuse Box

The fuse box houses all of the fuses for the Mach 5.0 and Mach 5.0 Plus.

2.2.4 Air (Pneumatic) Footswitch Connector

The pneumatic footswitch is the connection point for the footswitch when the Mach 5.0 and the Mach 5.0 Plus are integrated with the dental chair.

2.2.5 Electric Footswitch Connector

The electric footswitch is the connection point for the footswitch when the Mach 5.0 and Mach 5.0 Plus are not integrated with the dental chair and the electrical footswitch is used.

2.2.6 Air Supply

The Air Supply is the connection point for the external air source (Mach 5.0 only).

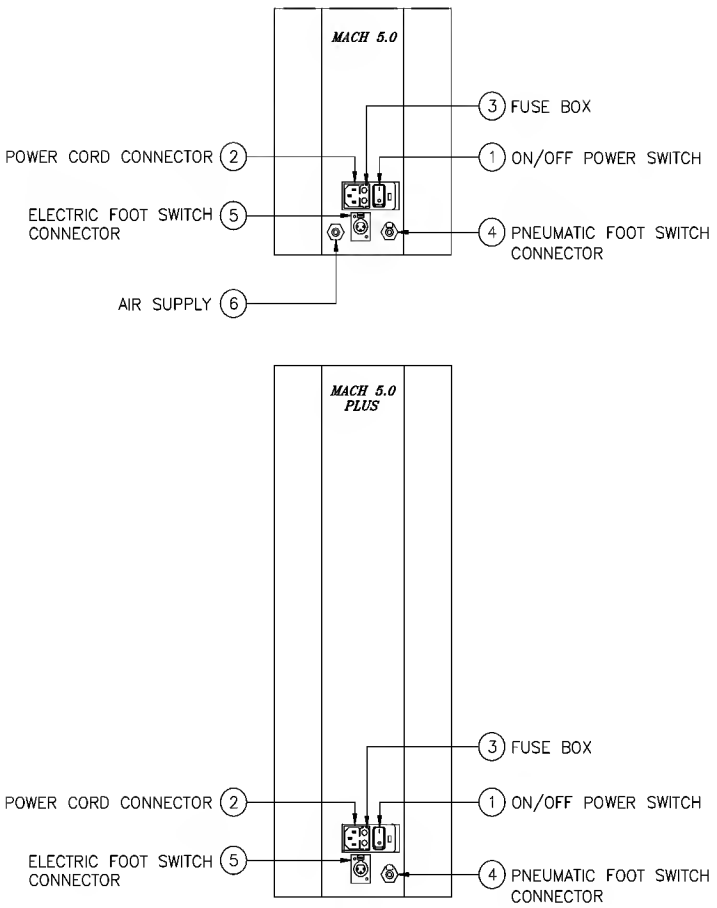


Figure 1 Systems Connections

2.3 Mach 5.0 and Mach 5.0 Plus Controls (Refer to Figure 2)

2.3.1 Remote Control Module

The Remote Control module is mounted on the front of the Mach 5.0 and Mach 5.0 Plus and attached by an RJ45 connector. All operating parameters are selected from the Remote Control module.

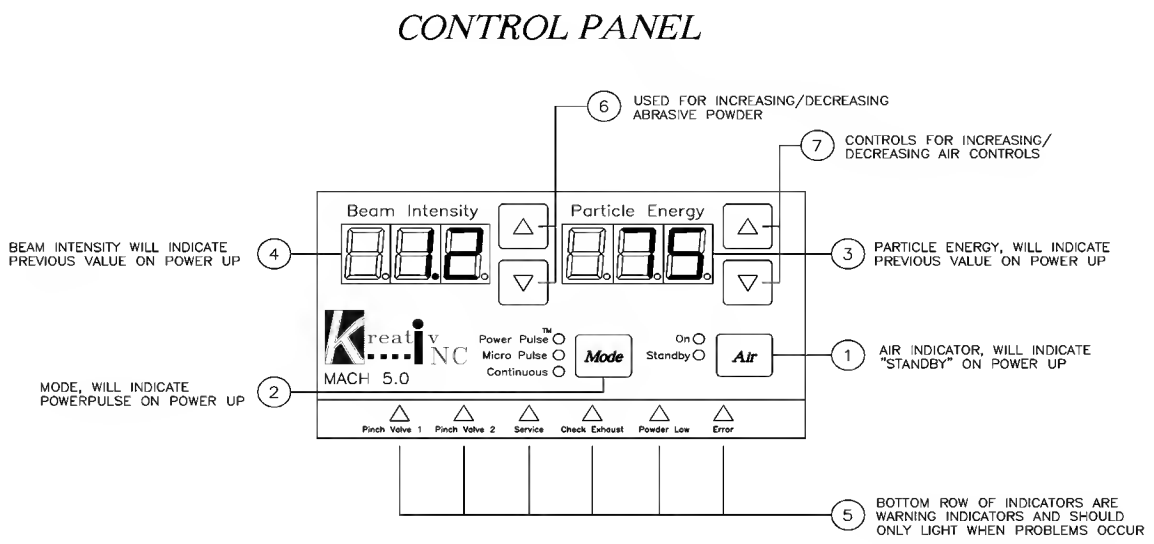


Figure 2 Remote Control

2.3.2 Air

The Air LED indicator identifies the status of the air pressure as On or Standby. In the Standby position, the LED is illuminated, the unit is depressurized, and it will not operate until the On position is selected and the unit pressurizes.

2.3.3 Mode

The user can select one of the following types of pulse modes:

- PowerPulse™ - Rapid cutting and amalgam removal with the Super Sonic Turbo handpieces.
- MicroPulse™ - Removal of tooth structure with the standard handpiece.
- Continuous - For microetching procedures with the standard handpiece.

2.3.4 Particle Energy

The Particle Energy adjusts the air pressure flow to the handpiece, controlling the internal air pressure. The Mach 5.0 and Mach 5.0 Plus Particle Energy can be set from 30 to 120 PSI. The Mach 5.0 and Mach 5.0 Plus air abrasion units are equipped with an internal pressure sensor to help the user identify when Low Air conditions arise.

The digital remote will illuminate the error code Low Air if the user has selected an air pressure (Particle Energy) higher than the available input air source. The unit will not operate until the user selects a lower air pressure. When

the user has selected the in-range setting, the Low Air error code will clear from the Remote Control and the unit will resume normal operation.

2.3.5 Beam Intensity

The Beam Intensity controls the amount or intensity of abrasive powder in the air stream, affecting the cutting speed. The Beam Intensity controls the vibrating action of the Powder Canister. On the scale of "0" to 10", "0" is very little powder and "10" is the maximum. The user should vary this setting to find the best performance.

2.3.6 Diagnostic

The Remote Control module has self-diagnostic LEDs identifying when specific maintenance is required. The following are the possible LED displays:

- Pinch Valve 1 & 2: When the Pinch Valve 1 or 2 LED is illuminated, the corresponding pinch tube has failed and requires the user to replace the tube. When a pinch tube fails, the pinch valve assembly sensor identifies a pressure increase within the captive block, thus causing the pressure sensor switch to close, completing the circuit and illuminating the LED. NOTE: The light may not illuminate with all pinch tube failures.
- Powder Low: The Powder Canister is equipped with an infrared light emitter and detector sensor. When the powder level falls below the sensors, an LED is illuminated.
- Error: The Error LED will illuminate when the user operates the footswitch with the unit in the Standby position and when the handpiece is not in the Remote Control handpiece holder during the power up sequence. The user must put the handpiece in the holder, set the unit to the ON position, lift the handpiece, and then press the footswitch. The Remote Control holder is equipped with a safety switch that requires the user to always return the handpiece to the holder, thus eliminating the possibility of powder release before the handpiece is at the point-of-use area.
- Check Exhaust and Service: The Check Exhaust and Service LEDs are not used at this time.

2.4 System Specifications

Power Requirements:	Mach 5.0 100-127 volt, AC, 60Hz, 400mA 220-240 volt, AC, 50Hz, 170mA Mach 5.0 Plus 100-127 volt, AC, 60Hz, 6.5 A 220-240 volt, AC, 50Hz, 3.5 A
Air Requirements:	Mach 5.0, 550-830 Kpa (80-120 PSI) Recommended
Approximate Size:	Mach 5.0, 30.4 cm x 45.7 cm x 21.5 cm (12" x 18" x 8.5") Mach 5.0 Plus, 63.5 cm x 45.7 cm x 21.5 cm (25" x 18" x 8.5")
Approximate Weight:	Mach 5.0, 15.9 kg. (30 lbs.) Mach 5.0 Plus, 38.6 kg (85 lbs.)

Environmental Limitations: Temperature: +10° C to 40° C (50° F to 104° F)
Humidity: 30% to 75%

2.5 Internal Components of the Mach 5.0 and Mach 5.0 Plus

(Refer to Figures 3, 4,and 5)

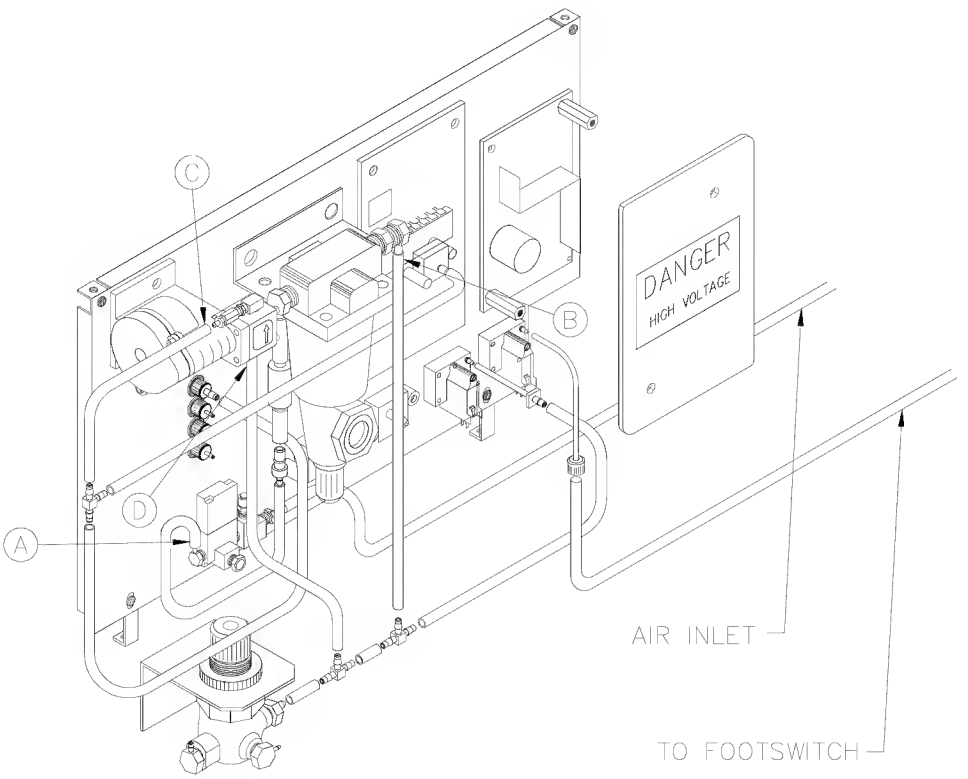


Figure 3 Stepper Motor MAP

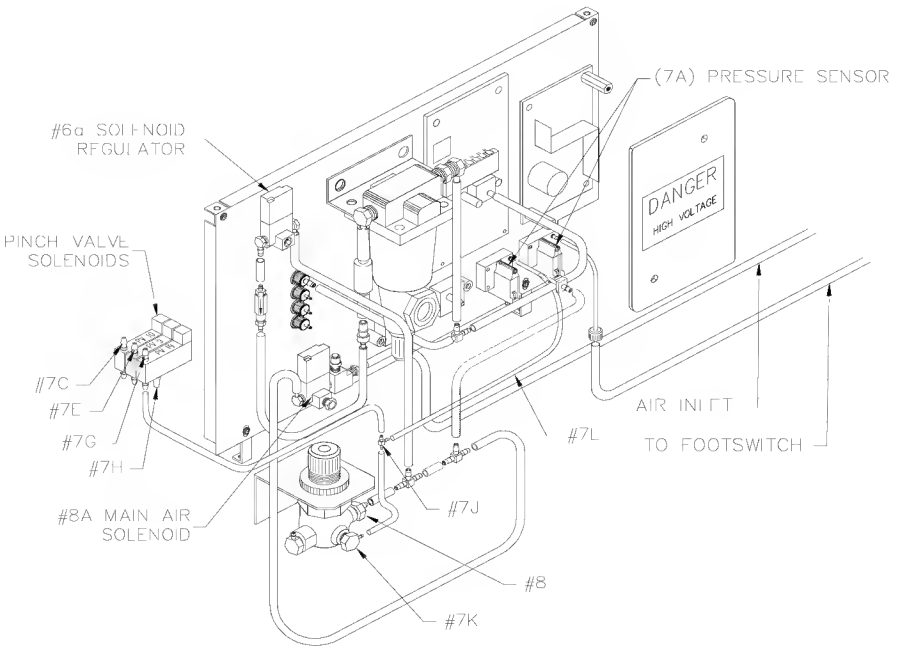


Figure 4 Solenoid Valve MAP

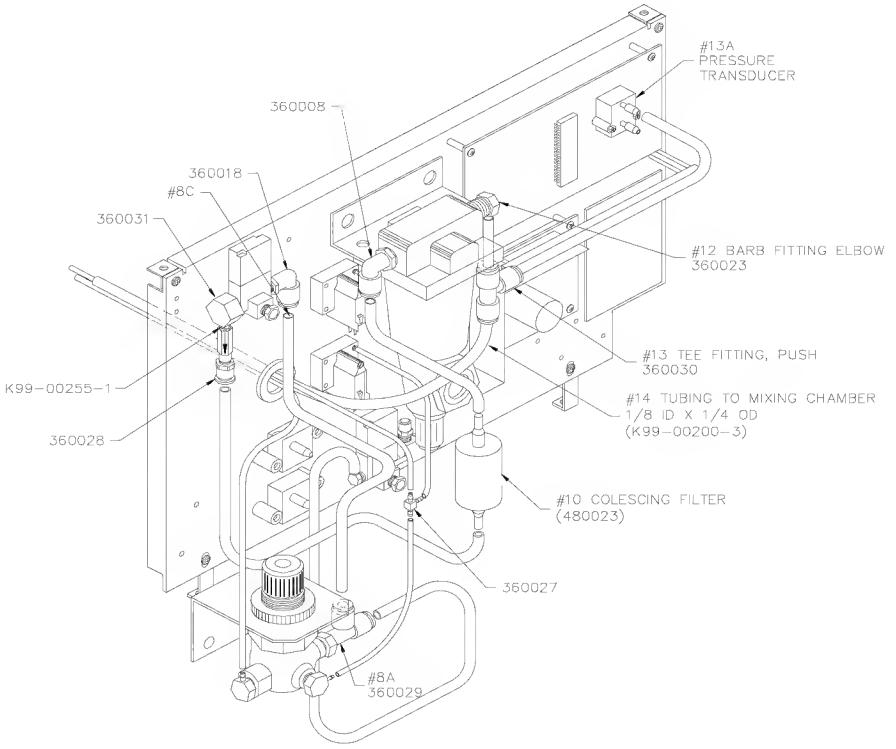


Figure 5 Solenoid and Fitting MAP

2.6 Pneumatic Flow Path Internal Component
(Refer to Figures 6, 7, and 8)

2.6.1 Air Compressor (Mach 5.0 Plus)

The Air Compressor is the motor component which generates the air supply and stores the compressed air into the accumulator tank.

2.6.2 System Pressure Regulator (Mach 5.0 Plus)

The System Pressure Regulator is the mechanical device which ensures that air supply does not exceed 130 PSI.

2.6.3 Coalescing Filter (Oil Mist Separator) (Mach 5.0 Plus)

The first Coalescing Filter in Figures 6, 7, and 8 is an Oil Mist Separator Filter. It is an in-line filter which ensures that small particulate matter and moisture/oil are removed from the compressor's air supply. NOTE: The NAFD2000 filter could degrade after one year and would require replacement.

2.6.4 Odor Removal Filter (Mach 5.0 Plus)

The Odor Removal Filter is an in-line charcoal filter which ensures that the air stream will remain odor free. NOTE: The NAMF250 filter could degrade and require replacement after one year.

2.6.5 Pressure Relief Valve

The Pressure Relief Valve is the mechanical device which ensures that the incoming air supply does not exceed 140 PSI. If the air supply exceeds 140 PSI, the valve will open, directing the air stream into the chassis to protect the downstream components from excessive pressures. The valve will automatically reset when pressures decrease.

2.6.6 Main Air Solenoid

The Main Air Solenoid comes after the Pressure Relief Valve and turns on and off the main air supply to the system.

2.6.7 Pressure Switch

The Pressure Switch signals the microprocessor that air pressure is available to operate the system. The internal air pressure within the switch must be at least 30 PSI to make contact and to send the signal to the microprocessor.

2.6.8 Stepper Motor/Regulator (Replaced with Solenoid Valve Pressure Regulator. Refer to Figure 6 only)

The Stepper Motor/Regulator increases or decreases air pressure on the Remote Control (Particle Energy).

2.6.9 Pinch Valve Regulator

The Pinch Valve Regulator maintains air pressure to the pinch valve solenoids.

2.6.10 Check Valve

The Check Valve ensures that air flows in one direction.

2.6.11 Solenoid Valve Pressure Regulator (On/Off Valve) (Replaced Stepper Motor/Regulator. Refer to Figure 7 and 8)

The Solenoid Valve Pressure Regulator increases or decreases air pressure according to the Remote Control (Particle Energy) setting.

2.6.12 Coalescing Filter

The Coalescing Filter removes small particulate matter and vapor moisture from the incoming air supply stream. If the filter is contaminated, water vapors and fogging will be present and noticeable through the filter housing. If

extreme moisture is present, the filter may turn pink which may indicate that the unit has been exposed to water. NOTE: The filter is a disposable type and will need to be replaced when the above conditions arise.

2.6.13 Ambient Dryer

The Ambient Dryer removes excess water from the incoming air supply. The filter housing is equipped with a viewing window to help the user identify if water is present. If water is present, the filter is equipped with an auto-dump valve, releasing the water into a collection bottle (Mach 5.0 Plus only) or chassis (Mach 5.0 only). The excess water in the filter housing can also be mechanically emptied by turning the valve to the open position.

2.6.14 Pressure Transducer

(PCA Pressure Assembly, Figure 6, and PCA Pressure Switch, Figures 7 and 8)

The Pressure Transducer senses the amount of air pressure available and sends a signal to the microprocessor.

2.6.15 Powder Canister

Powder and high pressure are incorporated in this reservoir. The Powder Canister has three components: powder is added to the Powder Canister; where the Orifice Plate then allows the abrasive powder and air to feed into the Mixing Chamber before exiting to the handpiece. The Powder Canister is under pressure when the Air On mode is selected and depressurizes when the Air Standby mode is selected. Air will not flow through the Powder Canister until the footswitch is pressed. The pressing of the footswitch opens the Abrasive Pinch Valve, allowing powder/air to flow to the handpiece, and activates the Vibrator Assembly, which vibrates the Powder Canister, causing the powder to flow through the Orifice Plate into the Mixing Chamber where air is combined with the powder.

2.6.16 Abrasive Pinch Valve Assembly

The Abrasive Pinch Valve Assembly controls the powder/air mixture to the handpiece. Pressurized air is controlled by the Abrasive Pinch Valve Solenoid entering the pinch valve block, pressurizing the piston chamber and forcing the piston and shoe to pinch the tube, thus blocking the powder/air mixture to the handpiece. When the footswitch is pressed, the air pressure to the Abrasive Pinch Valve is released by the Abrasive Pinch Valve Solenoid. The piston reacts by releasing the pinch tube, allowing the powder/air to flow to the handpiece. When the footswitch is released, air pressure is allowed to flow to the Abrasive Pinch Valve, thus forcing the shoe to pinch the tube and stop powder/air to the handpiece.

2.6.17 Dump Pinch Valve Assembly

The Dump Pinch Valve Assembly allows the system to depressurize when it is shut down, when pressure is decreased on Remote Control (Particle Energy), or when the system is placed in the Standby mode. (NOTE: It is necessary to depressurize the system when changing pinch tubes and adding abrasive powder.) When the unit is depressurizing, the pinch tube is open, allowing the pressure/powder to expel into the Exhaust Bottle. The internal workings of this pinch valve are the same as described in 2.6.16.

2.6.18 Bleed Pinch Valve Assembly

The Bleed Pinch Valve Assembly purges the handpiece and the hose of excessive powder by creating a suction, which empties powder into the Exhaust Bottle when the footswitch is released. The internal workings of this pinch valve are the same as described in 2.6.16.

2.6.19 Pinch Tubes

The Mach 5.0 and Mach 5.0 Plus equipment uses a series of three pinch valves to control the air and powder flow. The pinch valve assemblies are located on the internal mounting panel between the Mixing Chamber and the Exhaust Bottle. The three pinch valve assemblies are identified as #1, Abrasive Pinch Valve (bottom); # 2 , Bleed Pinch Valve (middle); and #3, Dump Pinch Valve (top).

Each pinch valve assembly has an internal pinch tube which needs to be replaced periodically. (Refer to Section 3.3.1. and 3.4.1.) The pinch tubes deteriorate due to piston action which occurs during normal operation of the Mach 5.0 and Mach 5.0 Plus equipment. The pinch tubes are located between the top and bottom shoe block covers, which are mounted on the pinch valve assemblies and are secured with two knurled thumb screws.

2.6.20 Exhaust Bottle

The Exhaust Bottle serves a dual purpose by collecting powder from the handpiece and hose when the footswitch is pressed or released. The Exhaust Bottle is also used to relieve air pressure when the unit is turned OFF or when switched to the Standby mode. The input to the Exhaust Bottle is connected to the Bleed and Dump Pinch Valve Assemblies. The powder must be emptied from the Exhaust Bottle daily. If the bottle is allowed to overfill, internal component damage can occur.

2.6.21 Handpiece

The handpiece delivers powder to the patient's tooth structure site. Kreativ offers a selection of handpieces with interchangeable nozzle sizes and angles for different applications. Super Sonic handpieces are designed to remove amalgam and do not include interchangeable nozzles.

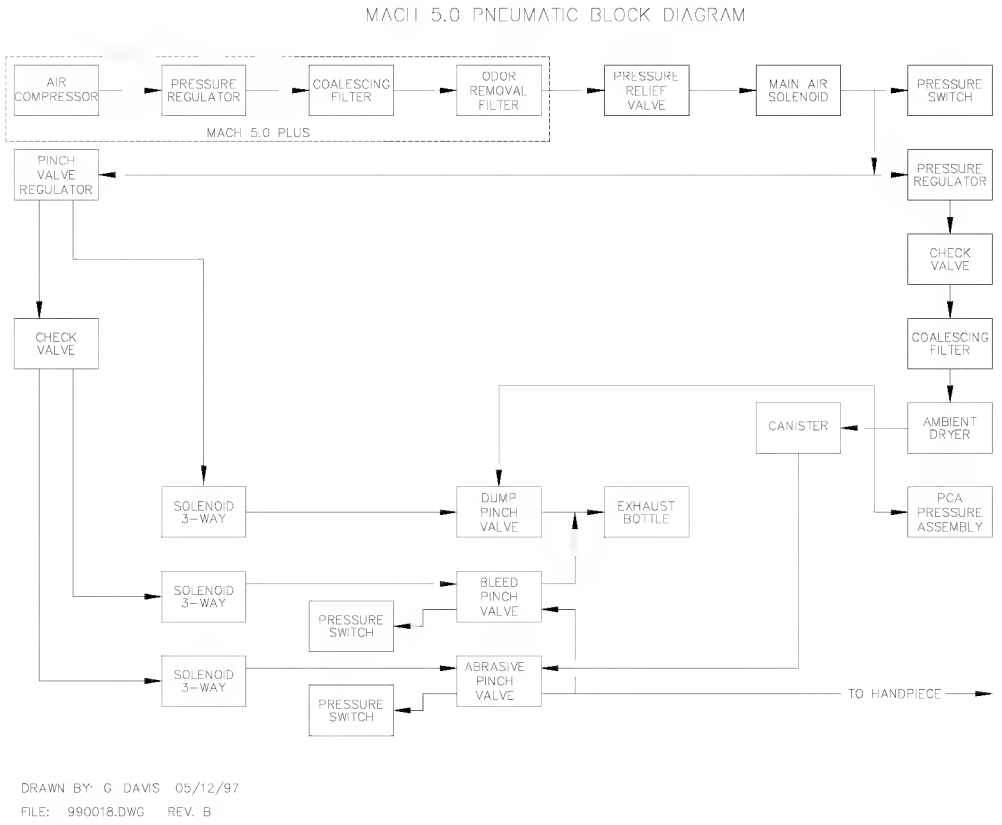


Figure 6 Stepper Motor Pneumatic Diagram

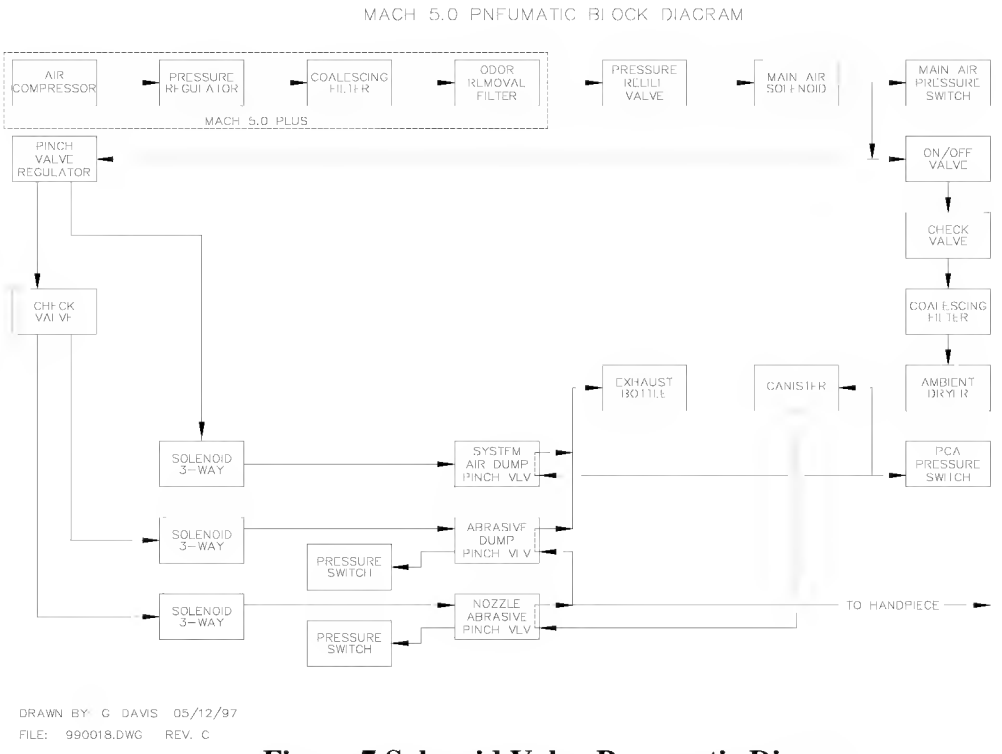


Figure 7 Solenoid Valve Pneumatic Diagram

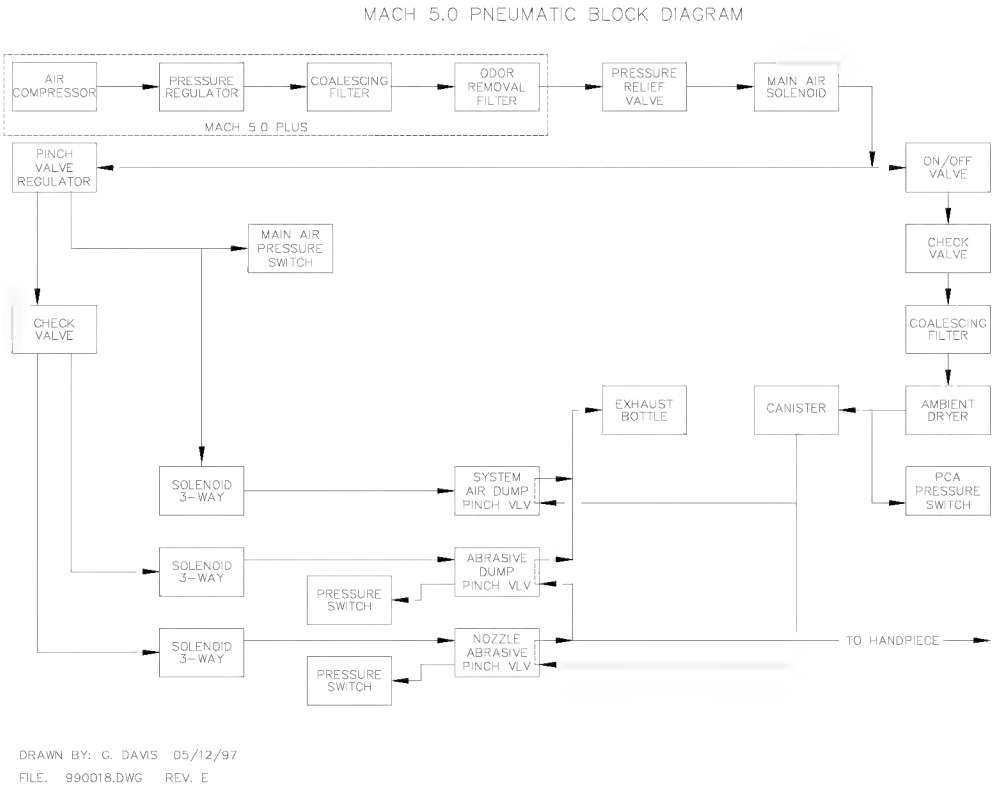


Figure 8 Solenoid and Fitting Pneumatic Diagram

2.7 Electrical/Electronic Components
(Refer to Figures 9, 10, and 11)

2.7.1 AC

Identifies 110 to 120 VAC. NOTE: International voltages (220 to 240 VAC) will have different electrical components.

2.7.2 RFI Filter

The RFI (Radio Frequency Interference) Filter blocks outside and inside interference and noise, which are not allowed. UL Testing shows that the RFI component was not required and was discontinued in later models.

2.7.3 Power Supply

The Power Supply contains a universal input, which automatically adjusts to AC voltages ranging from 100 to 260 VAC. The output to the Main PCA is DC voltages +/- 12 volts and + 5 volts.

2.7.4 Vibrator PCA

The Vibrator PCA controls the Vibrator according to communications from the microprocessor. The Vibrator PCA contains a 400 milliamp fuse to protect the unit in the event of Vibrator malfunction. **WARNING:** The Vibrator PCA uses AC line voltages and should not be serviced with the power in the ON position.

2.7.5 Vibrator

The Vibrator is controlled by the Vibrator PCA. The amount of vibration is controlled by the Beam Intensity via the Main PCA controlling the vibrator amplitude intensity (Beam Intensity). **WARNING:** The Vibrator uses AC line voltages and should not be serviced with the power in the ON position.

2.7.6 Main PCA

The Main PCA contains the main microprocessor which controls all electronic functions. It receives information from the Remote Control settings and acts according to user settings.

2.7.7 Remote Control PCA

The Remote Control PCA displays the following user selections: Beam Intensity, Particle Energy, Continuous, MicroPulse, and PowerPulse. It also includes the following status display LEDs: Pinch Valve 1 & 2, Powder Low and Error. (Service and Check Exhaust are not used in Versions A and B). The Remote Control sends the user-selected information to the Main PCA, using RS232 serial communication protocol. The Main PCA then sends the information back to the Remote Control to be displayed.

2.7.8 Stepper Regulator (Equipped on Version A models only)

The Stepper Regulator adjusts internal pressures according to the Remote Control setting selections. The Main PCA controls the Stepper Regulator via an electric stepper motor, adjusting the regulator to the user set pressure (Particle Energy).

2.7.9 Regulating Solenoid Valve (Replaced Stepper Regulator, Equipped on Version B models)

The Regulating Solenoid Valve adjusts internal pressures according to the Remote Control setting selection. The Main PCA controls air pressure by opening the valve, allowing air to flow until the desired pressure is obtained.

2.7.10 Main Air Solenoid Valve

The Main PCA sends an electrical signal to the Main Air Solenoid, allowing the Main Air Solenoid Valve to open and air pressure to enter the pneumatic flow path of the unit.

2.7.11 Dump Solenoid Valve

The Main PCA sends an electrical signal to the Dump Solenoid Valve, directing pinch valve action to release system pressure and to control the initial bursting of powder by diverting the powder stream to the Exhaust Bottle.

2.7.12 Abrasive Solenoid Valve

The Main PCA sends an electrical signal to the Abrasive Solenoid Valve, directing pinch valve action to deliver powder to the handpiece when the Remote Control On position mode is selected and the footswitch is pressed.

2.7.13 Bleed Solenoid Valve

The Main PCA sends an electrical signal to the Bleed Solenoid Valve, controlling pinch valve action when the footswitch is released, immediately ending the powder flow from the handpiece.

2.7.14 Main Air Pressure Switch

The Main Air Pressure Switch sends an electrical signal to the microprocessor upon sensing system pressure when the Main Air Solenoid is pressurized or depressurized. When the unit is in the Standby position, the Main Air Solenoid is disabled (contacts open); and when in the On position, the Main Air Solenoid is enabled (contacts closed).

2.7.15 Bleed Pressure Switch

The Bleed Pressure Switch sends an electrical signal to the microprocessor when air pressure is sensed in the switch, indicating that the pinch tube has ruptured, thus illuminating the Pinch Valve 2 LED on the Remote Control. The Pinch Valve 2 LED identifies the middle pinch valve block assembly. **NOTE:** Not all pinch tube failures will cause an error signal.

2.7.16 Abrasive Pressure Switch

The Abrasive Pressure Switch sends an electrical signal to the microprocessor when a change in air pressure is sensed in the switch, indicating that the pinch tube has ruptured, thus illuminating the Pinch Valve 1 LED on the Remote Control. Pinch Valve 1 LED identifies the bottom pinch valve block assembly. **NOTE:** Not all pinch tube failures will cause an error signal.

2.7.17 Air (Pneumatic) Footswitch

The Electrical Interface for the pneumatic footswitch sends an electrical signal to the microprocessor identifying that a pneumatic footswitch is used to operate the unit.

2.7.18 Footswitch

The footswitch sends an electrical signal to the microprocessor identifying that an electrical footswitch is used to operate the unit.

2.7.19 Low Powder Emitter and Detector

The Low Powder Emitter constantly sends an infrared light signal to the Low Powder Detector. When the powder is allowed to fall below the emitter, the detector senses the infrared light and sends an electrical signal to the microprocessor, thus illuminating the Low Powder LED on the Remote Control.

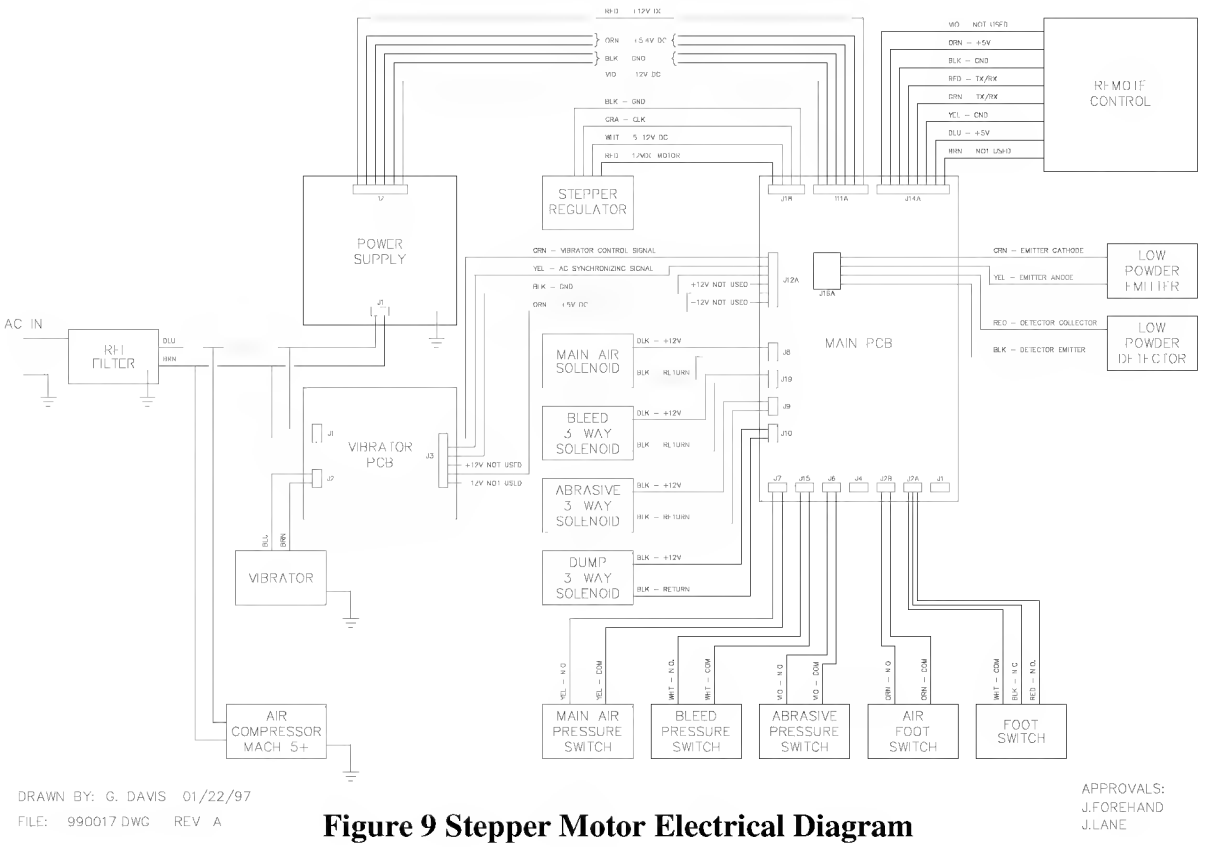


Figure 9 Stepper Motor Electrical Diagram

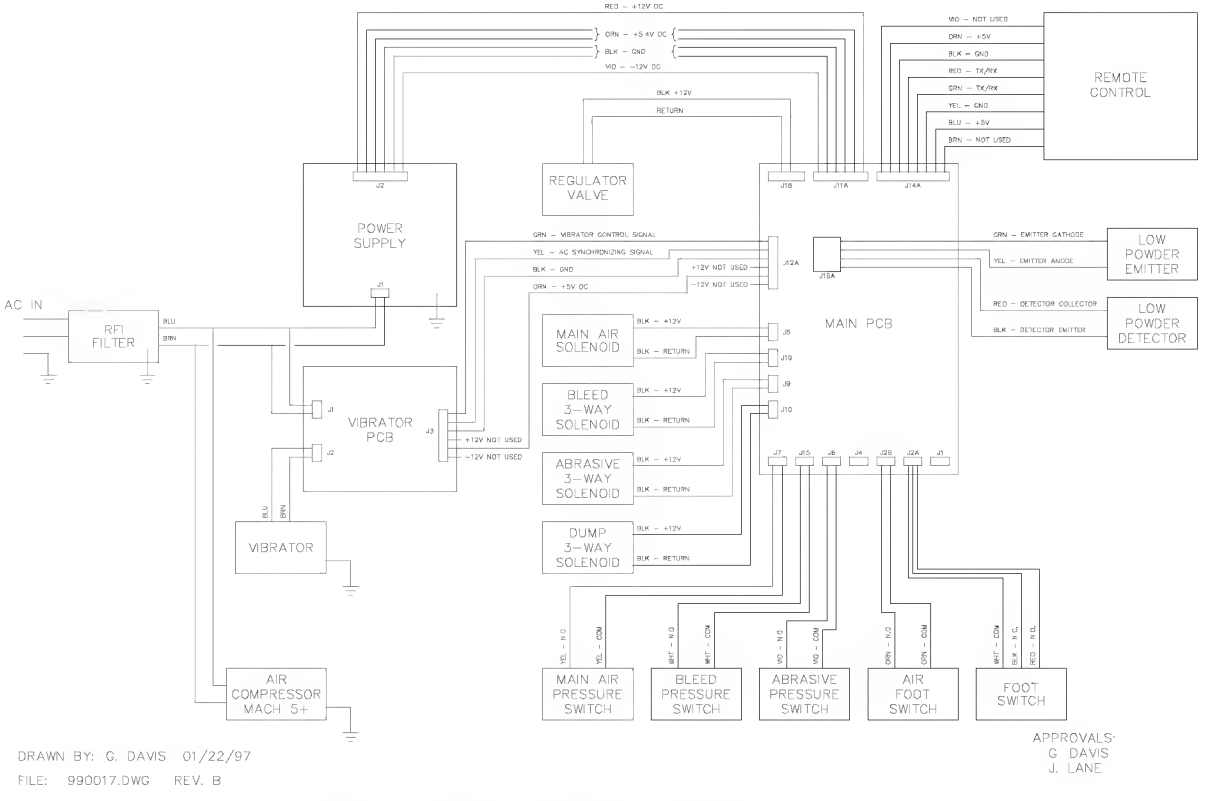


Figure 10 Solenoid Valve Electrical Diagram

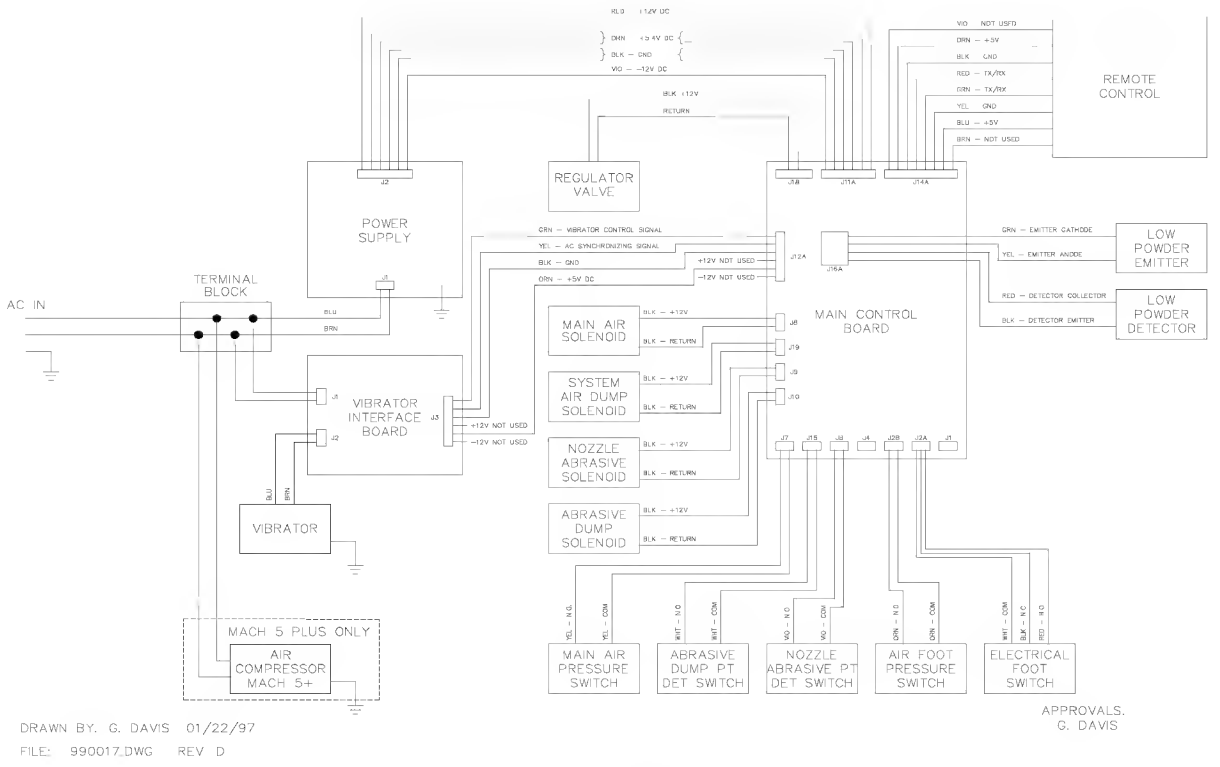


Figure 11 Solenoid and Fitting Electrical Diagram

3. ROUTINE MAINTENANCE

3.1 Routine Maintenance of the Mach 5.0 and Mach 5.0 Plus

Kreativ Air Abrasion systems have been designed to operate with a minimum of operator attention. Like all mechanical systems, they will operate longer and with less trouble when operator maintenance is performed regularly. Maintenance on a Kreativ Air Abrasion system is limited to cleaning, infrequent lubrication, pinch tube replacement, and filter cartridge replacement. The maintenance procedures have been categorized by their frequency of action and are described in this chapter with specific instructions.

3.2 Daily Requirements

3.2.1 **Powder Canister** (Refer to TSB #6)

Observe the Remote Control diagnostic LEDs. If the Powder Low LED is illuminated, powder will need to be added to the Powder Canister. If Pinch Valve 1 or 2 LEDs are illuminated, a pinch tube has ruptured (see instructions under Bi-Weekly and Monthly Requirements). Check Exhaust and Service should never illuminate as these diagnostic codes are not currently available.

Observe the powder level in the Powder Canister, and inspect the powder for possible moisture contamination; powder will not flow evenly if moisture is present or if the powder has a wet sand appearance. Replace the powder if it is contaminated. Add new powder, and clean the threads on the top of the canister. Remove and clean the white cap gasket, and clean the cap. Reinstall the gasket. Clean the cap ring threads, and install the cap with the gasket side down, and screw the cap ring securely. If the cap ring is not secure, air leaks can occur which will affect cutting efficiency.

NOTE: To check the powder level in the Powder Canister, it is necessary to switch the unit to the Standby mode to release the internal pressure in the canister. If the canister is pressurized or in the On mode, the user will not be able to unfasten the cap ring.

Complete the following procedure to empty the Powder Canister:

1. Ensure that the unit is in the Standby mode or in the OFF position.
2. Open the left side door. NOTE: Door locks may be installed and will require a key to unlatch the door.
3. Remove the lid from the Powder Canister by turning the cap ring/lid counterclockwise.
4. Loosen the Retaining Block by unfastening the black star knob until the Retaining Block can slide freely to remove the Powder Canister. NOTE: Observe the placement of hoses to ensure proper alignment upon reinstallation.
5. Empty the Powder Canister.
6. Use a brush or a vacuum to remove any powder remaining in the canister.

NOTE: It is necessary to empty the Powder Canister if the unit will be stored for a period of six weeks or more. This will ensure that the powder is not subject to humid air conditions which may contribute to "heavy" powder, causing the Orifice Plate Holes to clog.

Cleaning the Powder Canister:

If the Air Supply source contains moisture or other contaminants, the powder may clog the Orifice Plate Holes. Complete the following procedure to unclog the holes:

1. Repeat the procedures for "Emptying the Powder Canister", steps 1-4.
2. If powder is heavily contaminated, discard it. If the powder looks "heavy", place the powder in a microwaveable container. With the microwave set on high, cook the powder for 45 seconds. Set aside and let cool.
3. Re-install the Powder Canister without the powder. Also ensure that the Retaining Block is securely fastened.
4. In the bottom of the canister, there are a series of eight small holes. Two of the holes are sealed and marked with a black line. With a .0015 Endo file or an Ortho wire, gently penetrate through the openings. NOTE: Do not penetrate the sealed holes. Only remove the clogs. Too much filing could possibly result in excess powder flow.
5. Replace the canister lid securely.
6. Ensure that the handpiece nozzle is not clogged by gently penetrating the nozzle opening with an Endo file.
7. With the unit in the On position, with the Beam Intensity set at "10", and with the Particle Energy at the highest available pressure (Mach 5.0 Plus 120 PSI), point the handpiece into the *KleanAir*® System or vacuum. Press the footswitch for approximately one minute to purge the system. Return to the Standby mode.
8. Refill the Powder Canister with abrasive powder.

3.2.2 **Exhaust Bottle** (Refer to TSB #2 and #7)

Observe the powder level in the Exhaust Bottle. The Exhaust Bottle should be emptied every time that the Powder Canister is filled or sooner. Care should be taken when reinstalling the bottle, by cleaning the internal threads on the filter housing and on the bottle. Other factory recommendations include checking the filter retaining nut to ensure that the internal filter in the Exhaust Bottle has not loosened. The retaining nut is located at the bottom of the internal filter.

Failure to maintain the Exhaust Bottle may result in an overflow situation and will adversely affect the operation of the pinch valve components. The following conditions may occur:

1. Low Air or ERR 13 illuminates across the Remote Control display panel.
2. A large bursting of powder occurs as the footswitch is pressed, followed by a dramatic decrease in powder flow.
3. Powder exits the Pressure Relieve Orifice resulting in chassis contamination.
4. Powder continues to flow when footswitch is released.

If any of the above conditions arise, factory recommendations are as follows:

1. Turn the machine to the Standby position.
2. Carefully remove the Exhaust Bottle, and discard the powder.
3. Ensure that the internal filter is secured; if it is not, remove and clean the parts thoroughly. Then reinstall.
4. Clean the threads on the housing and the Exhaust Bottle, and reinstall.
5. Turn the machine to the Air On position.
6. Set the Beam Intensity to "10", Particle Energy to "120" or the highest available pressure.
7. Set the machine to the Powerpulse position.

8. Direct the handpiece into the *KleanAir* system or into the vacuum system, and press the footswitch for 2-3 minutes to clear any possible powder obstructions in the system.
9. Empty the Exhaust Bottle and add new powder to the Powder Canister.
10. Test the unit for proper operation.

3.3 Bi-Weekly Requirements

3.3.1 **Abrasive Pinch Tube** (Refer to TSB #8)

Recommendations for periodic pinch tube replacement are as follows. (Replace even if the Remote Control LEDs are NOT illuminated).

1. Replace the Abrasive Pinch Valve (#1 or Bottom) weekly. (This is dependent upon usage. If usage increases, changing schedule should increase.)
2. Replace the Dump and Bleed Pinch Valves (#2 & #3) monthly. (See Section 3.4 "Monthly Requirements". This is dependent upon usage. If usage increases, the changing schedule should increase.)

Other conditions which are common with pinch tube failures are as follows:

1. Changes in air and powder flow will result in erratic and/or poor cutting efficiency.
2. The Particle Energy may have difficulty reaching and maintaining desired setting.
3. Low Air may illuminate on the Remote Control display.
4. If the pinch tubes are not replaced when failure has occurred, an audible air leak will be apparent and abrasive powder will eventually discharge into the chassis.
5. In the attempt to change pinch tubes, the user may inadvertently neglect to get the shoe block covers secure. Minimize the gap to ensure proper performance.

Complete the following procedure to change a pinch tube:

1. Switch the unit into the Standby mode. Wait until the unit has depressurized.
2. Remove the bottom pinch valve block by turning the thumb screws counterclockwise.
3. Remove the worn pinch tube by gently pulling it from the fittings. Discard the tube.
4. Insert a new pinch tube, and place the fittings and pinch tube into the bottom block indentations.
5. Replace the top block, ensuring that the fittings and pinch tube align properly. Secure the top block with the thumb screws. **CAUTION:** Failure to ensure the top and bottom block are secure will result in an air leak situation or may potentially cause damage to the internal components.
6. Resume normal operation.

An additional factory recommendation is to inspect the shoe block covers for wear whenever a pinch tube has been replaced. Maintenance negligence of pinch tube replacement will result in scarred shoe block covers and may contribute to additional internal component damage, again resulting in equipment malfunction.

3.4 Monthly Requirements

3.4.1 **Dump and Bleed Pinch Tube** (Refer to TSB #8)

Follow the same procedures as listed in the 3.3 Biweekly Requirements.

3.4.2 Check Oil Level (Mach 5.0 Only)

The Mach 5.0 Plus air abrasion unit is equipped with an internal air compressor. The air compressor does not require any general maintenance except adding oil. The compressor is equipped with a viewing window that has a minimum/maximum indicator line to help the user identify when oil is required. Complete the following procedure to add oil:

1. Ensure that the unit's power is in the OFF position, and remove the power cord from the electrical outlet.
2. Open the right side door.
3. With a crescent wrench, remove the top hex plug, located on the top center of the compressor head, by turning counterclockwise.
4. The Mach 5.0 Plus equipment is shipped with extra oil and tubing for future use. NOTE: Use factory-specified oil only.
5. Cut a small portion of the oil container nipple. Slide the tubing onto the oil container nipple.
6. Set the open end of the hose into the hole where the hex plug was removed.
7. Gently squeeze the container of oil, paying attention to the minimum/maximum viewing window. When the oil reaches the maximum level, discontinue adding the oil by removing the tubing.
8. Replace the hex plug, and ensure that it is tight.

3.4.3 Handpieces and Nozzles

The handpieces and nozzles for the Mach 5.0 and Mach 5.0 Plus can be sterilized by any standard dental autoclave, ultrasonic sterilizer, or manual sterilization practices. After removal from the autoclave, it is important to allow the nozzles and handpieces to dry completely before use. If the handpieces and nozzles are not allowed to dry, the handpiece and nozzles may become clogged.

If clogging occurs, complete the following procedure:

1. Remove the handpiece assembly from the handpiece hose.
2. Blow air into both the nozzle and handpiece ends.
3. If the air fails to resolve the clogging, use an Endo file or Ortho wire to penetrate the nozzle opening.

The nozzles are subject to wearing and will require replacement eventually. Indications of wearing on the nozzle are a decrease in cutting efficiency and an undefined stream of powder flowing from the nozzle.

3.5 Annual Requirements

3.5.1 **In Line Pre-Filters** (Refer to Section 3.17 Maintenance Checks)

The following in line pre-filters will need to be replaced on an annual or "as needed" basis.

1. Intake Muffler (Mach 5.0 Plus only)
2. Oil/Water Coalescing Filter, NAFD2000 (Mach 5.0 Plus only)
3. Odor Removal Filter, NAMF250 (Mach 5.0 Plus only)

4. Water Vapor Coalescing Filter, only if filter indicates pink color.

3.5.2 Internal Tubing

The internal tubing should be inspected for wear and for air leakage. The following tubing should be replaced before eruption occurs:

1. Super hose from the Powder Canister to the pinch valve(s).
2. Super hose from the pinch valve to the handpiece hose connection (internal).
3. Clear tubing from the top and middle pinch valves to the Exhaust Bottle.

3.5.3 Powder Canister

The Powder Canister cap gasket should be replaced.

3.5.4 Fittings

1. The fittings on the pinch valve assemblies should be inspected for wear and replaced if necessary. The fittings are lined with carbide to ensure fitting longevity, but will wear eventually.
2. The brass fitting that connects hose to handpiece should also be replaced.

3.5.5 Pinch Valve Assemblies (Refer to Section 3.17 Maintenance Checks)

Lubricate the Pinch valve assemblies to ensure proper powder delivery. A Pinch Valve Maintenance Kit (P/N 150028) is available with all of the necessary pinch valve parts. (See Figure 33 [K01-00185-1], Section Eight).

Complete the following procedures to lubricate the pinch valve assemblies:

1. Ensure that the unit is in the OFF position and that the power cord is disconnected from the electrical outlet.
2. Open the right side door.
3. Start with the top pinch valve assembly. NOTE: Do not attempt to complete all three pinch valve assemblies at the same time since the tubing connection routing can easily become confused.
4. Remove the thumb screws, turning counterclockwise to remove the top shoe block. Discard the shoe block. Set the thumb screws aside.
5. Pull the pinch tube from its fittings. Discard the pinch tube, and inspect the fittings for wear. Replace the fittings if necessary.
6. With a small slotted screwdriver, remove the set screws for the bottom shoe block, turning counterclockwise, ensuring that pressure is applied to the bottom shoe block, since a spring is behind the shoe block which may dislodge unexpectedly. Discard the bottom shoe block. Lay the set screws aside.
7. With the bottom shoe block removed, a spring and shoe will dislodge freely.
8. Discard the shoe. Set the spring aside.
9. With a small set of needle nose pliers, remove the retaining ring. Set it aside.
10. Remove the diaphragm. Discard it .
11. Remove the piston. Remove the o-ring from the piston, and discard it.
12. Replace the new piston o-ring, and lightly apply lubricant around the o-ring. NOTE: Only factory specified lubricant (Superlube) should be used.
13. Set the piston aside.
14. Clean all parts thoroughly.
15. Thoroughly clean the internal pinch valve assembly.

16. Generously lubricate the internal piston portion of the pinch valve assembly.
17. Re-assemble pinch valve assembly.
18. Repeat this procedure for Pinch Valve 2 and 3.

3.6 Technical Services Bulletin #1
Stepper Motor Replacement & Software Revision

Effective May 12, 1997, the Stepper Motor Regulator (used to drive the air pressure up or down) has been replaced with a new design because of frequent failure. The new regulator design is mounted in the same previous location. Plumbing connections have also been affected. NOTE: The last four digits of the serial numbers are 6400 for the Mach 5.0 and 7300 for the Mach 5.0 Plus.

Because of the Stepper Motor replacement, new software revisions have also occurred. The following describes the notable operational changes provided with the new software (M-5 Rev 97132 MC):

1. All LED and number displays will momentarily illuminate for approximately 1 second.
2. The Beam Intensity will show A.C., and the Particle Energy will show the line frequency in cycles per second (Hz). The reading will be 50 or 60.
3. The Remote Control will then go into normal operating mode, showing the last Beam Intensity mode selected, the last Particle Energy mode selected, and the last Cutting mode setting selected.
4. The air will be in Standby mode, and the Powder Low LED will be illuminated if the unit is low on powder.
5. When the air is turned On, the unit will then begin to adjust the air pressure to the set value.
6. The footswitch will be rendered inoperable if either the Beam or Particle settings are being adjusted.
7. Once the unit reaches the values set, the footswitch will be operable again.
8. Because of the new regulator design, the sound of the unit has changed from a quiet gear mesh to a clicking sound.
9. Low Air will display on the Remote Control if the air selection exceeds the amount available; the unit will be inoperable until a correct value is selected. For example, if the doctor only has 60 PSI available to the unit and selects 80 on the Remote Control, Low Air will show on the Remote Control until 60 is selected.

Stepper Motors can fail and need replacement. At that time, the units affected will be retrofitted with the new regulator design and software changes. The regional areas are to supply loaner equipment to the customer or the equipment will be sent back to the factory for repair. Sales personnel will assist with the retrofit.

This document has been supplied to the Regional V.P. and has been approved for release to the field. If other complications occur, contact the nearest authorized Welch Allyn / Kreativ service representative.

3.7 Technical Service Bulletin #2 *KleanAir* Hose Assembly & Exhaust Bottle Issues

3.7.1 *KleanAir* Hose Assembly

Recently, service has experienced telephone calls regarding the *KleanAir* II hose assembly. The hose assembly will fall apart if not handled carefully.

The hose assembly can be re-attached by simply pushing and twisting both loose ends together. Insert the solid piece into the v-channel.

To eliminate the problem, customers should be informed to stretch out the hose assembly before bending and do not make sharp bends.

3.7.2 Exhaust Bottle Assembly

Due to problems with powder exiting the Pressure Relief Orifice opening (see #1 of Figure 12), the diffuser (see #3 of Figure 12) has been eliminated from production units effective immediately. If customers are experiencing this problem, advise them to remove the diffuser. Upon re-assembly, it is imperative that the filter is centered properly, creating a very tight seal. NOTE: If the filter is out of alignment or not sealed properly, powder will continue to exit the pressure relief opening.

If other complications occur, contact the nearest authorized Welch Allyn / Kreativ service representative.

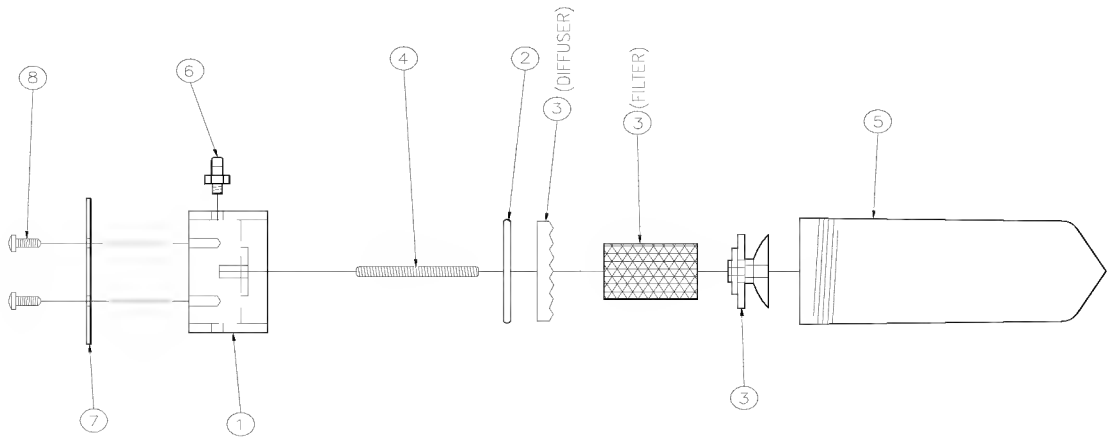


Figure 12 Exhaust Bottle Assembly

3.8 Technical Service Bulletin #3 Excessive Powder Issues

3.8.1 Excessive Powder Flow Issues

Effective July 27, 1997, a kit is now available for any customers who are experiencing excessive powder flow issues. The procedure is uncomplicated and can be done by the doctor or staff members.

- Tools Required

  5/32" allen wrench (Mach 5.0, Mach 5.0 Plus, & Mach 4.0)

  3/16" allen wrench (Mach 4.0)

- Equipment Required

  Orifice Plate Assembly

  Orifice Plate Gasket

- Procedure

  Mach 5.0 and 5.0 Plus

  1. Turn the unit OFF.
  2. Open the door where the Powder Canister is located.
  3. Remove the canister from the mounting plate, but do not remove the hoses from the canister. NOTE: Before removing the canister from the mounting plate, keep in mind how the hoses are placed. Turn the star knob counterclockwise, and slide the plate and washers outward to remove the canister from the mounting plate.
  4. Unfasten the Powder Canister lid, and empty the contents.
  5. On the bottom of the canister is three 5/32" allen screws. Turn them counterclockwise to remove.
  6. Remove the bottom plate from the canister.
  7. Remove the Orifice Plate Assembly (it has eight small holes and a stem) by shaking or pushing the stem.
  8. Place the gasket inside the Mixing Chamber.
  9. Reassemble the Powder Canister, and attach it to the mounting plate, ensuring that all screws are fastened tightly.

  Mach 4.1

  1. Turn the unit OFF.
  2. Open the door where the Powder Canister is located.
  3. The Mach 4 model utilizes three 3/16" allen screws to hold the Powder Canister to the mounting plate. Turn the allen screws counterclockwise to remove the canister from the mounting plate. NOTE: Before removing the canister from the mounting plate, keep in mind how the hoses are placed.
  4. Follow the above steps 4-9.

  If other complications occur, contact the nearest authorized Welch Allyn / Kreativ service representative.

3.9 Technical Service Bulletin #4 Remote Control Bracket And Door Locks

3.9.1 Door Locks

Effective immediately, all units manufactured by production are installed with door locks. A key is required to access the inside of the unit. This feature was added for our UL listing which is still pending.

It is advisable to carry a key with you at all times. Please call the factory if spares are needed.

3.9.2 Remote Control Bracket

Effective immediately, all new units manufactured will have the new style Remote Control bracket. The new bracket does not require magnets and has a housing surrounding the Remote Control. This feature is an improvement since the Remote Control will stay stationary even if it is accidentally bumped. The doctor may order the new style Remote Control bracket, but will need to peel the magnets off the back of the Remote Control. NOTE: The magnets are not needed to hold the Remote Control to the Mach 5.0 and 5.0 Plus front panels.

If other complications occur, contact the nearest authorized Welch Allyn / Kreativ service representative.

3.10 Technical Service Bulletin #5 Excessive Powder - Powder Flow Enhancement

Effective immediately, November 3, 1997, all Mach 5.0 and 5.0 Plus equipment is installed with new software (M5 Rev. 292 MC) and has a plumbing configuration change.

The change was implemented to improve the powder flow. Many users complained about an initial powder bursting and erratic powder flow even at low settings. The new change practically eliminates the initial powder burst and refines the powder flow. Some of the noticed changes are that the Beam Intensity may need to increase. Because the initial powder flow has been redirected to the Exhaust Bottle, cycling the footswitch is not recommend. The user will also need to check and/or empty the Exhaust Bottle more frequently.

The software change enables the machine to recall the last selected setting (when the unit is switched to Standby and then the power is turned OFF). Additional software capabilities include self diagnostic error codes which enable the factory to troubleshoot more accurately. The codes will appear on the Remote Control as ERR 0 through 15. Each code has a definition identifying potential component problems or failures.

A kit is available for customers if required and is easily installed. The part number is 150021 and is available from the manufacturing facility. NOTE: The powder enhancement may not be appropriate for all existing customers, especially if they are not complaining about problems.

If other complications occur, contact the nearest authorized Welch Allyn / Kreativ service representative.

3.11 Technical Service Bulletin #6 General Maintenance For Mach 5.0 & Mach 5.0 Plus Mixing Chamber

3.11.1 Powder Canister

The Mach 5.0 and Mach 5.0 Plus equipment uses a Powder Canister for powder delivery. To maintain optimal powder flow and cutting efficiency, the Powder Canister should be filled to a level of ¾" from the top of the canister with Gamma Pure™ abrasive powder. The Mach 5.0 and Mach 5.0 Plus Remote Control display Low Powder LED will illuminate when abrasive powder needs to be added. When this occurs, powder should be added prior to the next scheduled procedure.

Complete the following procedures to add powder to the Powder Canister:

1. Turn the machine to the Standby mode which will depressurize the canister.
2. Inspect the powder for possible moisture contamination; powder will not flow evenly if moisture is present or has a wet sand appearance. Replace the powder if contaminated.
3. Add new powder.
4. Clean the threads on the top of the canister.
5. Remove and clean the white cap gasket and clean the cap. Reinstall the gasket.
6. Clean the cap ring threads.
7. Install the cap with the gasket side down, and screw the cap ring securely. If the cap ring is not secure, air leaks can occur which may affect cutting efficiency.
8. Turn the machine to the On mode.

WARNING: Never connect the Mach 5.0 into a water line. If this condition occurs, the equipment will need to be repaired by a factory-trained technician. The following immediate steps should be taken to prevent further internal component damage:

1. Turn the unit OFF, and disconnect the water line.
2. Empty the Powder Canister entirely.
3. Replace the cap, and secure tightly.
4. Connect the proper air line to the unit.
5. Set the Beam Intensity to "10" and Particle Energy to "120" (if available) in the Continuous mode.
6. Run the unit with the footswitch pressed for approximately five minutes.

If other complications occur, contact the nearest authorized Welch Allyn / Kreativ service representative.

3.12 Technical Service Bulletin #7 General Maintenance Mach 5.0 & Mach 5.0 Plus Exhaust Bottle

3.12.1 Exhaust Bottle

The Exhaust Bottle is an integral operational component of the Mach 5.0 and Mach 5.0 Plus equipment and must be properly maintained. The Exhaust Bottle serves as a dual purpose component by collecting abrasive powder when the footswitch is pressed or released and by relieving air pressure when the unit is turned OFF or when switched to the Standby mode.

The Exhaust Bottle should be emptied based on usage (if you use the unit daily, check and/or empty the bottle daily). Care should be taken when reinstalling the bottle, by cleaning the internal threads on the filter housing and on the bottle. Other factory recommendations include checking the filter retaining nut to ensure the internal filter in the Exhaust Bottle has not loosened. The retaining nut is located at the bottom of the internal filter.

Failure to maintain the Exhaust Bottle may result in an overflow situation and will adversely affect the operation of the pinch valve components The following conditions may occur:

1. Low Air or ERR 13 illuminates across the Remote Control display panel.
2. Large burst of powder occurs as the footswitch is pressed, followed by a dramatic decrease in the powder flow.
3. Powder exits the Pressure Relieve Orifice, resulting in chassis contamination.
4. Powder continues to flow when the footswitch is released.

If any of the above conditions arise, factory recommendations are as follows:

1. Turn the machine to the Standby position.
2. Carefully remove the Exhaust Bottle, and discard the powder.
3. Ensure that the internal filter is secured; if not, remove and clean the parts thoroughly, and reinstall.
4. Clean the threads on the housing and bottle, and reinstall.
5. Turn the unit to the On position.
6. Set the Beam Intensity to "10", Particle Energy to "120 "or the highest available pressure.
7. Set unit to the Powerpulse position.
8. Direct the handpiece into the *KleanAir* or a vacuum system, and press the footswitch for 2-3 minutes to clear any possible powder obstructions in the system.
9. Empty the Exhaust Bottle, and add new powder to the Powder Canister.
10. Test the unit for proper operation.

If other complications occur, contact the nearest authorized Welch Allyn / Kreativ service representative.

3.13 Technical Service Bulletin #8 General Maintenance Mach 5.0 & Mach 5.0 Plus Pinch Tube Replacement

3.13.1 Pinch Tubes

The Mach 5.0 and Mach 5.0 Plus equipment uses a series of three pinch valves to control air and powder flow. The pinch valve assemblies are located on the internal mounting panel between the Mixing Chamber and the Exhaust Bottle. The three pinch valve assemblies are identified as #1, Abrasive Valve (bottom); #2, Bleed Valve (middle) and #3, Dump Valve (top).

Each pinch valve assembly has an internal pinch tube which needs to be replaced periodically. The pinch tubes deteriorate due to piston action which occurs during normal operation of the Mach 5.0 and Mach 5.0 Plus equipment. The pinch tubes are located between the top and bottom shoe block covers, which are mounted on the pinch valve assemblies and are secured with two knurled thumb screws.

Factory recommendations for periodic pinch tube replacement are as follows:

1. Abrasive Pinch Valve (#1) - Bi-Weekly
2. Dump and Bleed (#2 & #3) - Monthly

The Mach 5.0 and Mach 5.0 Plus equipment is equipped with internal components which sense when pinch tube #1 and #2 have failed. The Remote Control LEDs may illuminate when this condition occurs.

Other conditions which are common with pinch tube failures are as follows:

1. Air and powder flow changes resulting in erratic and/or poor cutting efficiency.
2. The Particle Energy may have difficulty reaching and maintaining the desired setting.
3. Low Air may illuminate on the Remote Control display.
4. If the pinch tubes are not replaced when failure has occurred, an audible air leak will be apparent and abrasive powder will eventually discharge into the chassis.
5. In the attempt to change pinch tubes, the user may inadvertently neglect to get the shoe block covers secure. Minimize the gap to ensure proper performance.

An additional factory recommendation is to inspect the shoe block covers for wear every six months or when a pinch tube has blown. Maintenance negligence of pinch tube replacement will result in scarred shoe block covers and may contribute to additional internal component damage, again resulting in equipment malfunction.

If other complications occur, contact the nearest authorized Welch Allyn / Kreativ service representative.

3.14 Technical Service Bulletin #9 Mach 5.0 Plus New Compressor

Effective March, 17, 1998, the Jun Air compressor used in the Mach 5.0 Plus air abrasion equipment will be replaced with a Werther International air compressor. Werther International will be used as the primary supplier, and Jun Air will become the secondary supplier. The change was implemented to help control cost and to have alternative component sources available.

The Werther International compressors are assembled similarly to the Jun Air, although there are slight design differences. The Intake Filter is slightly smaller and placed **directly** into the compressor head at an angle. **CAUTION:** The intake cap, which is installed prior to shipment to avoid oil leakage, is a "snap plug" style and **must** be removed prior to compressor start up. Failure to remove intake cap may result in compressor damage.

Other noticed configuration differences are as follows:

1. The generated air from the compressor enters the Accumulator Tank opposite of the Jun Air.
2. The Accumulator Outlet Valve is a ball style versus the needle valve on the Jun Air.
3. The safety pressure relief component is mounted just below the front of the switch box cover versus the rear of the switch box on the Jun Air.
4. The header assembly for the oil collection bottle is mounted vertically versus horizontally on the Jun Air.
5. The Werther International compressor is black and the Jun Air is silver.

If other complications occur, contact the nearest authorized Welch Allyn / Kreativ service representative.

3.15 Technical Service Bulletin #10 Mach 5.0 & Mach 5.0 Plus Super Hose Issues

3.15.1 Super Hose

Effective immediately, March 10, 1998, all Mach 5.0 and Mach 5.0 Plus equipment is equipped with an upgraded internal super hose to help prolong the hose life. This change was implemented due to the number of failure incidents reported to the factory.

The new super hose has a thicker wall resulting in a larger outer diameter and is located in three sections: from the Mixing Chamber to the top pinch valve, from the top pinch valve to the bottom pinch valve, and from the bottom pinch valve to the bulkhead fitting.

To retrofit existing equipment, a kit and drawing is available from the Technical Services Department. The procedure can be easily performed on the current Mach 5.0 and Mach 5.0 Plus versions. If the equipment is installed with the old mounting panel, it will be necessary to remove the Vibrator Interface Board to reach the bulkhead fitting. **WARNING:** Before attempting to remove the Vibrator Interface board, disconnect power cord from unit. The vibrator interface board is held in place with four small Phillips screws.

Equipment serial numbers installed with the old mounting panel are as follows:

Mach 5.0: ending in 6000 through 6400

Mach 5.0 Plus: ending in 7000 through 7300

If other complications occur, contact the nearest authorized Welch Allyn / Kreativ service representative.

3.16 Technical Service Bulletin #11

Not Applicable

3.17 Technical Service Bulletin #12

Not Applicable

3.18 Technical Service Bulletin #13 General Information For Mach 5.0 & Mach 5.0 Plus Abrasive Cutting Control

3.18.1 Abrasive Cutting Control

The Mach 5.0 equipment utilizes a Beam Intensity adjustment to control powder delivery. The settings are adjustable from "0" to "10". This controls the intensity at which the Powder Canister vibrates. A setting of "0" represents no vibration; but does not represent zero abrasive cutting. A setting of "10" represents maximum vibration, but does not necessarily represent maximum cutting ability. This memo is intended to describe the many variables that affect cutting control on the Air Abrasion systems. Each technique listed below will affect the cutting efficiency differently; and by using different combinations of these techniques, one can achieve a wide range of cutting characteristics.

1. Air Pressure Selection

   The amount of air pressure plays a big role in the cutting efficiency. The higher the air pressure, the higher the velocity of the abrasive particles will be. Also the higher pressure causes more air flow. More air flow pulls more powder out of the Powder Canister. When air pressure is adjusted, the user may need to adjust other parameters to control the amounts of powder flow.

2. Nozzle Tip Selection

   The size of the hole in the end of the nozzle tip affects the amount of air flow and powder flow. If all the parameters are held constant, the gray (.011) tip will allow the least amount of powder flow, the green (.014) will allow a little more powder flow, and the blue (.018) will allow even more powder flow. The user should feel comfortable to change to smaller tips when less powder is desired, and should be aware that nozzle tips do wear out. If the tip is worn, the user will encounter poor cutting efficiency.

3. Powder level in Powder Canister

   The amount of powder in the Powder Canister has an affect on the amount of powder flow. When the canister is full of powder, there will be more powder flow than when the canister is half full. The user should know that as the powder level in the canister drops, so does the amount of powder flow. If less powder flow is desired, do not fill the canister to the top.

4. Mode Selection

   Powerpulse is the most aggressive cutting mode, Micropulse is the second most aggressive cutting mode, and Continuous is the least aggressive mode. The user should notice different powder flow characteristics according to which mode is selected.

5. Methods of using the handpiece nozzle

   The distance that the nozzle is held from the cutting surface, the angle that the nozzle is pointing at the cutting surface, and the movement of the handpiece during cutting will affect how aggressive the cut will be. Moving the nozzle tip away from the tooth will result in less cutting; different angles will cut differently; and the faster the handpiece is moved, the less cutting will occur. The user should experiment with different methods of handling the handpiece nozzle.

6. Length of time of cutting

   The length of time that the footswitch is held down affects the amount of powder flow. When the switch is first pushed, there is an initial burst of powder. After that the powder flow will be at the minimum. If the switch is held active for more than 10 seconds, it is more likely that the powder flow will increase. If the user wants more powder flow, he should keep the switch closed for long periods of time. If the user notices that the powder flow is increasing during a long switch activation, release the switch, wait a couple of seconds, and start again. Do not repeatedly pump the switch more than than once every three seconds. Pumping the switch too fast can actually cause less cutting efficiency.

This bulletin is intended to offer information on how to best control abrasive cutting efficiency of the Mach 5.0 series Air Abrasion systems. The user should practice using different combinations of the above techniques to find a cutting efficiency that best fits a particular application.

If other complications occur, contact the nearest authorized Welch Allyn / Kreativ service representative.

3.19 Maintenance Checks

			Labor
PM 1.	**Maintain pinch valve blocks (6 Months)**		1 hour
	Replace pinch tubes (3)	K99-00319-3	
	Clean, lubricate and replace pinch valve parts		
	Clean the Compressor Intake Filter		
	Clean out the Compressor Overflow container		
	Replace Handpiece clips (Mach 5.0 and 5.0 Plus)	340001	
PM 2.	**Maintain Overflow Filter (6 months)**		.25 hour
	Clean out bowl, filter, and base threads (Mach 4.0, 4.1, 5.0, and 5.0 Plus)		
PM 3.	**Replace the Exhaust Bottle Filter (12 months)**		5 hour
	Mach 5.0 and 5.0 Plus Exhaust Filter	480081	
	Replace Compressor Intake Filter (Jun Air)	370007	
	or		
	Replace Compressor Intake Filter (Silent Air)	370023	
	Mach 4.0 and 4.1 Exhaust Filter	K99-00333-1	
	O ring	K99-00302-2	
PM 4	**Maintain tubing within the unit (6 months)**		1.0 hour
	Replace super hose (black, 1.75 ft) (Mach 4.0 and 4.1)	K01-00404-1	
	Replace clear 1/8" ID tubing (1.5 ft)	K99-00200-3	
	Replace "Y" piece and tubing (2.5 ft) (Mach 4.0 and 4.1)	360004	
	Replace Nipple Fittings (2)	K01-00172-1	
	Replace Brass Fitting (1)	K99-00243-1	
	Replace large super hose (black, 2.5 ft)	390008	
PM 5	**Maintain Powder Canister (6 months)**		.75 hour
	Purge all system tubes		
	Replace upper Powder Canister gasket/clean lid	K01-00154-1	
	Clean and turn over the base cap gasket		
	Clear Orifice Plate holes		
	Measure Orifice Plate holes (replace if necessary)	K01-00182-1	
PM 6	**Replace Powder Canister components (12 months)**		.75 hour
	Replace Orifice plate	K01-00182-1	
	Replace lower base cap gasket	K01-00153-1	
	Replace Orifice plate gasket	210082	
PM 7	**Calibrate system (12 months)**		1.0 hour
	Verify and calibrate using procedure 980063		
PM 8	**Change the compressor oil (24 months)**		1.0 hour
	Change the compressor oil (2 bottles)	K99-00116-1	
	Replace the Compressor Intake Filter (Jun Air)	370007	
	or		
	Replace the Compressor Intake Filter (Silent Air)	370023	
	Clean out the Compressor Overflow container		

4. TROUBLESHOOTING

4.1 Remote Control LED Indicators

PROBLEM	SYMPTOM(S)	SOLUTION
Error LED is illuminated.	Operational LEDs are fully illuminated but nothing occurs when the footswitch is depressed.	Reset the "safety" microswitch, located on the inside of the handpiece cradle. This error occurs when the user does not place the handpiece in the cradle before the unit is placed in Standby mode.
Powder Low LED is illuminated.	The unit is fully operational, but the user may notice a decline in cutting speed and efficiency.	Add abrasive powder to the Powder Canister.
Powder Low LED is NOT illuminated, and powder is below the detector sensors.	No powder flows from the handpiece.	Replace the Powder Level Sensor on the Powder Canister.
Powder Low LED is continuously illuminated when Powder Canister is full.	Unit is fully operational, but the LED is constantly illuminated.	Replace the Powder Level Sensor on the Powder Canister.
Pinch Valve 1 LED is illuminated.	Powder flow is erratic, or cutting efficiency decreases. Also powder may release from the handpiece even in the Standby mode.	Replace pinch tube #1.
Pinch Valve 2 LED is illuminated.	Same as above conditions.	Replace pinch tube #2.
"LO AIR" appears on Display windows.	The Remote Control displays are fully operational, but the unit will not function when the footswitch is pressed.	• Check to ensure that the Air Inlet Hose is connected. • Check to ensure that air supply is available at the chair connection.

PROBLEM	SYMPTOM(S)	SOLUTION
.	Air source is present, but the "LO AIR" display remains illuminated and the unit will not operate when the footswitch is pressed.	The user has selected a higher pressure (Particle Energy) than is available. The user must lower the air pressure until Low Air vanishes.
	"LO AIR" display is continuously illuminated at any selected Particle Energy even when air is available to the unit.	• The Pressure Sensor Switch is not calibrated properly. To test, swap J7 and J2B connectors on the PCA. If the problem goes away, reconnect J7 and J2B to their original configuration and turn the screw on the pressure sensor counterclockwise not more than 1 to 1 ½ turns. If problem still exists, replace the Pressure Sensor Switch. • The Main Air Input Solenoid Valve is not functioning. Verify activation signal from the Main PCA. If signal is present, replace Main Air Solenoid Valve. If no signal is present, replace Main PCA. • The Pressure Regulating Solenoid Valve is not functioning. Verify the signal from Main PCA. If the signal is present, replace the Regulating Solenoid Valve. If no signal is present, replace the Main PCA.
.	"LO AIR" display is continuously illuminated at any selected Particle Energy with the machine clicking continuously.	The unit has an internal air leak occurring. Check all hose connections and components (i.e. Coalescing Filter housing, powder sensors on Powder Canister and Powder Canister cap gasket. User does not have the cap on the Powder Canister tightened properly.

4.2 Powder Flow Problems

PROBLEM	SYMPTOM(S)	SOLUTION
No powder or air from the handpiece nozzle.	Operational LEDs are fully functional, but there is no powder or air.	• The handpiece is clogged. Use an endo or ortho wire to clear the nozzle. Disconnect the handpiece from the handpiece hose and blow air through it. • Tee fittings on upper and lower valve assemblies are clogged. Unfasten the pinch valve block covers, remove the pinch tubes, then gently move an endo or ortho wire back and forth on the inside diameter of the tee fitting.
Air from the handpiece but no powder flow.	Operational LEDs are fully functional.	• Verify that the Vibrator is functioning by selecting the Beam Intensity from "1" to "10" to check for vibrating differences. Verify that the connector cable from the Power Supply to Vibrator Interface PCA is connected and that

PROBLEM	SYMPTOM(S)	SOLUTION
		the connector from the Vibrator Interface PCA is connected to the Vibrator. • Clogged orifice plate. Empty the powder from the canister. With an endo or ortho wire, gently move the wire back and forth in the small holes in the bottom of the Powder Canister. (NOTE: Eight holes are present; two are marked black. DO NOT place the files in those holes as they are purposely plugged.) Damp or wet powder causes this situation, and the powder must be dried thoroughly before use. Powder can be dried by placing it in a microwaveable container and cooking the powder on high for 30 to 60 seconds
Air and powder from the handpiece flow for only a few seconds then stop.	Unit is fully operational, but powder only flows for a few seconds when the footswitch is pressed.	• The Exhaust Bottle is overfilled. Empty and clean the Exhaust Bottle. • A pinch tube is sticking. Replace the pinch tube.
Air and powder flow continuously from handpiece even when in the Standby mode.	Pinch Valve #1 LED is illuminated, indicating that a pinch tube has blown.	• Change pinch tube valve #1. • Shoe block covers have become scarred. Replace the shoe block covers.
Air and powder blowing out of the pressure relief open-ing on the upper housing of the Exhaust Bottle.	Powder residue inside chassis.	The Internal Exhaust Bottle Filter is loose. Tighten the internal filter by removing the clear housing and tightening the filter. Cleaning may be required to ensure proper alignment.
Powder inside the unit chassis.	Powder all throughout the unit.	Check powder flow path hoses and connections to ensure that no wear or ruptures are apparent. Replace worn fittings or hoses.
Unit makes a clicking sound even in the Standby mode.	The Main Air Regulator is unable to stabilize.	Check for air leaks on all hoses, fittings, and components. Use leak detect to help identify where leaks are occurring. Replace failed components. Ensure that the Powder Canister lid is secure. Also clean the cap gasket.

4.3 Fault Condition and LED Codes

The fault condition codes will illuminate on the Remote Control display when the microprocessor is unable to transmit or receive certain electrical impulse signals.

4.3.1 ERR 01: Internal Microprocessor Check

When powering up, the microprocessor conducts a self check of the two internal timer circuits 0 &1. Timer 0 must be within the 1% correct count after 50 m/sec. Timer 1 overflows if timer 0 fails to count the 50 m/sec. If either one of these checks fails, the system will lock up, and ERR 01 will illuminate across the Remote Control display. To correct ERR 01, it is necessary to turn the unit off for 10 seconds to reset. If ERR 01 is persistent, replace the microprocessor.

4.3.2 ERR 02: +12 Volt Status Check

When powering up, the microprocessor checks the +12 volt status and verifies that it falls in the range of +11.1 volts to +14.3 volts. Since the Power Supply cannot normally be adjusted outside this range, this error is simulated by shorting R11 which does not allow voltage at the microprocessor input pin. When this occurs, ERR 02 displays on the Remote Control. To correct, isolate the Power Supply from the Main PCA and ensure that the voltage from the Power Supply is +12 volts. If voltage is +12 volts, replace the Main PCA; if it is not +12 volts, replace the Power Supply.

4.3.3 ERR 03: Not currently used

4.3.4 ERR 04: EEprom Status Check

When powering up, the microprocessor sends a signal to the EEprom and then re-checks to verify that the EEprom is functioning correctly. If the microprocessor cannot verify the stored signature, the Remote Control will display ERR 04. To correct this condition, replace the Main PCA.

4.3.5 ERR 05: Zero Crossing Sensor Check

When powering up, the microprocessor checks for a signal generated by the Vibrator Interface PCA. The signal from the Vibrator Interface PCA identifies when the AC line signal crosses zero. If the signal is present, the microprocessor counts the time between zero crossing signals and determines if the line frequency is 50 to 62 Hertz. If the signal is not present or out of range, the Remote Control display will illuminate ERR 05. The ERR 05 condition can occur if the cable from the J12A Main PCA connection is not properly connected. Ensure that connections are tight. Error 05 can also occur if the AC line to the Vibrator board is damaged. If the AC line is damaged, replace the Vibrator Interface Board.

4.3.6 ERR 06: Panel Communication Port Status Check

When powering up, the microprocessor checks the communication with the Remote Control microprocessor. If there is a problem with communication, the Remote Control will illuminate ERR 06. The ERR 06 condition can occur if the cable between the Remote Control and the Main PCA is loose or damaged and if the microprocessors on the Main Control Board and the Remote Control are not properly plugged in. To correct, ensure that the cable is secure and connectors are not damaged. If ERR 06 is persistent, replace Remote Control PCA or Main PCA.

4.3.7 ERR 07: Pressure Switch Status Check

When powering up, the microprocessor checks to ensure that the Main Air Pressure Switch is turned off. The unit should be in the Standby mode at this point. If the microprocessor senses pressure, the Remote Control will illuminate ERR 07. The ERR 07 can occur if the Main Air Solenoid is not functioning properly. Verify the operation of the Main Air Solenoid. Replace if not functioning. ERR 07 can also occur if the Pressure Switch is not adjusted properly. Turn the adjusting screw on the pressure switch not more than 1 to 1 ½ turns counterclockwise. Replace Pressure Switch if ERR 07 is persistent. If ERR 07 cannot be resolved with the replacement of the Main Air Solenoid and the Pressure Switch, replace the Main PCA.

4.3.8 ERR 08: Not Currently Used

4.3.9 ERR 09: Pressure Sensor Over-Range Check

After the Main Air Pressure Switch is turned on, the microprocessor checks the pressure to ensure that it does not exceed the maximum limit (120 PSI). If pressure exceeds the maximum level, ERR 09 will illuminate across the Remote Control display. To correct ERR 09, calibrate, with a pressure gauge, the Pressure Transducer by adjusting R16 on the Main PCA to match the Remote Control display. (See Section 6.3.9, "Setting the Main Control Board Pressure Transducer", for further information). If turning the potentiometer is unsuccessful, replace the Main PCA.

4.3.10 ERR 10: Not Currently Used

4.3.11 ERR 11: Not Currently Used

4.3.12 ERR 12: Not Currently Used

4.3.13 ERR 13: Regulator Pressure Release Check

After the power is ON and the unit is taken from the Standby mode to the On mode, the microprocessor monitors the downward adjustment of air pressure. If the air pressure does not release properly, the Remote Control will illuminate ERR 13. Verify that the Exhaust Bottle is not overfilled. An overfilling condition will not allow the unit to depressurize properly. Empty and clean the Exhaust Bottle. Verify that the handpiece is not clogged. Verify that the pinch valve tubes are not sticky or worn. Replace pinch tubes if they are sticky or worn. If ERR 13 is continuously persistent, replace the Regulating Solenoid or replace the Main PCA.

4.3.14 ERR 14: Not Currently Used

4.3.15 ERR 15: Excessive Air Pressure Check

While the footswitch is being activated (pressed), the main microprocessor monitors the regulated air pressure to assure that the Regulating Solenoid Valve does not stick open. If the Regulating Solenoid Valve sticks open and the air pressure is erratic, the microprocessor will shut the Regulating Solenoid off and ERR 15 will illuminate across the Remote Control display. To correct ERR 15, replace the U4 Driver Chip on the Main PCA or replace the entire Main PCA.

5. Installation Considerations

5.1 Site Preparation for Kreativ Air Abrasion Systems

Kreativ Air Abrasion systems require an external source of clean, dry, compressed air or nitrogen and a standard 110 volt outlet. In most cases your existing dental compressor is adequate. Compressed nitrogen or an alternative compressed air source can be used if your present office compressor cannot supply enough pressure.

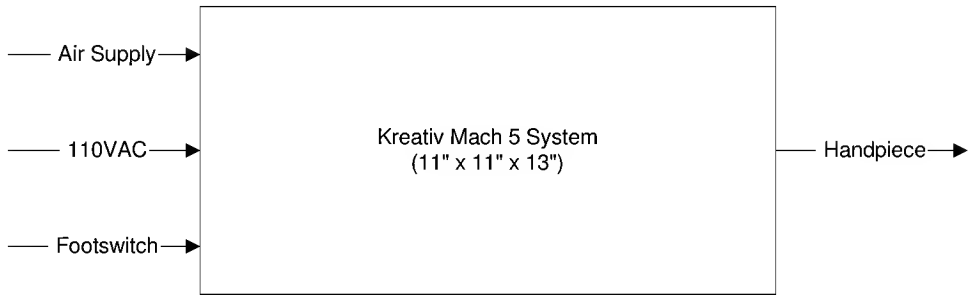


Figure 13 Connection of the Kreativ Air Abrasion System

High Volume Evacuation system: Use of a high volume evacuation system (HVE) is necessary when using the Air Abrasion System. Your in-office high volume evacuation system can be used. The abrasive should not damage your system as long as it is properly maintained. Kreativ's *KleanAir* system used in conjunction with your HVE will optimize the evacuation of any abrasive that escapes from the oral cavity as well as spray from rinsing and gases of fumes from materials used in the preparation. (Review the *KleanAir* brochure for more information.)

There are three possible sources for compressed air/nitrogen available for use with the Kreativ Air Abrasion system. Review all three options to determine which is best for you.

- Option #1 Present In-Office Compressor System
- Option #2 Compact Compressor System
- Option #3 Compressed (bottled) Nitrogen

NOTE: Other bottled gases such as compressed air or CO2 are NOT usable. They contain water and oil which will cause the system to clog and not work properly.

5.1.1 Option #1: Present In-Office Compressor System

In most cases the Kreativ Air Abrasion system can use your existing dental compressor. The following will enable you to determine if your compressor can supply the needed pressures/air:

- Air pressure: The Kreativ Air Abrasion system requires a maximum of 120 PSI and a minimum of 80 PSI of clean, dry air. Check with your compressor service company regarding the capability of your compressor system.

- Air Dryer System: Clean, dry air is absolutely essential for the Kreativ Air Abrasion system to operate properly. Moisture or oil in the air supply cause clogging in the abrasive flow path and prevent the unit from operating or cutting properly. Kreativ suggests that you have your dryer system checked and serviced prior to installation of the system. Kreativ offers a small in-line dryer/filter system that can be connected in-line with the air abrasion system if clogging problems do occur.
- Connecting the Kreativ Air Abrasion system to the office air supply: Since the proper tools and training, as well as knowledge of how your system operates, are necessary, it is important for your compressor service company to install the air supply connection. The Air Supply Line can be connected at any point in the Main Air Line between the System Dryer and the Operatory Regulator (see Figure14). The most common hook up is a supply line with a "quick disconnect" fitting so that the air abrasion system can be moved easily from operatory to operatory. A 10-foot long air supply hose with a quick disconnect fitting on each end is provided with the air abrasion system. The fitting is a standard size and type (Parker Company P/N #393P-4-4).

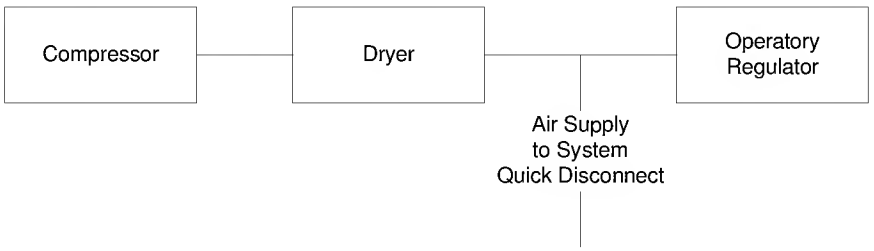


Figure 14 Connecting Air Abrasion Unit to In-Office Air

5.1.2 Option #2: Compact Compressor System

Kreativ has designed an optional, small, quiet, and compact compressor system that is powerful enough to supply dry, clean air to as many as four air abrasion systems. It operates on a standard 110 volt outlet. The compressor is small enough to fit in a cabinet, on a small cart, or under a counter. You may want to put it in a utility room and have the air supply hose run a short distance to the operatory. The compressor operates so quietly that one usually cannot hear it over the noise of other equipment/instruments already in the operatory. The system's simple and reliable design insures minimal maintenance.

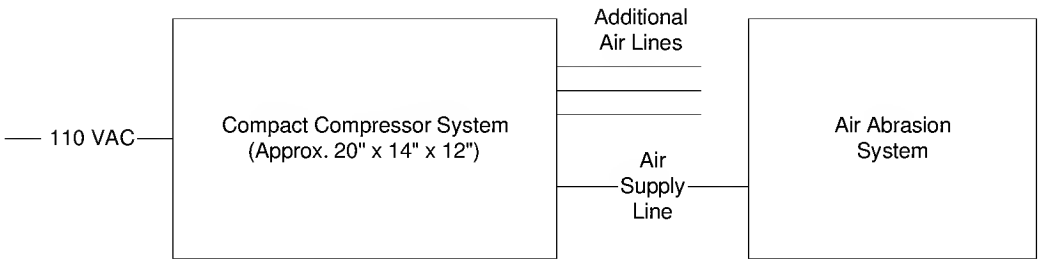


Figure 15 Connecting Kreativ's Compressor System

5.1.3 Option #3: Compressed (bottled) Nitrogen

The Kreativ Air Abrasion system can operate on compressed (bottled) nitrogen. Bottles and tanks of various sizes are readily available anywhere in the country from your dental supply company or local bottled gas supplier. The size of the bottle you order will depend on where you decide to store it. A smaller bottle could be placed on a small cart and moved from room to room, but being smaller, it would need to be refilled more often. A larger bottle can be stored in one place, and supply line(s) can then be run to the operatory(s) where you plan to use the system. How long a bottle/tank will last will depend on the size of the tank and the daily usage. You should consider the following when looking at this option:

- Size bottles/tanks that are available
- Storage requirements
- The cost of having the bottle/tank refilled

Kreativ recommends a regulator that is adjustable to no more than 125 PSI. We have tested several regulators and have found that either of the regulators listed below to be most suitable:

- Harris Company
  Regulator model 425-125-580 SI
  Contact your local gas supplier.
  (Available from Welch / Allyn Kreativ)
- Victor Company
  Regulator model VTS 253 D
  Contact your local gas supplier.

CAUTION: Other regulators will work but can be adjusted to 200 PSI or higher. Damage will occur if pressure higher than 145 PSI is applied. Damage due to extreme over pressure is not covered by the warranty.

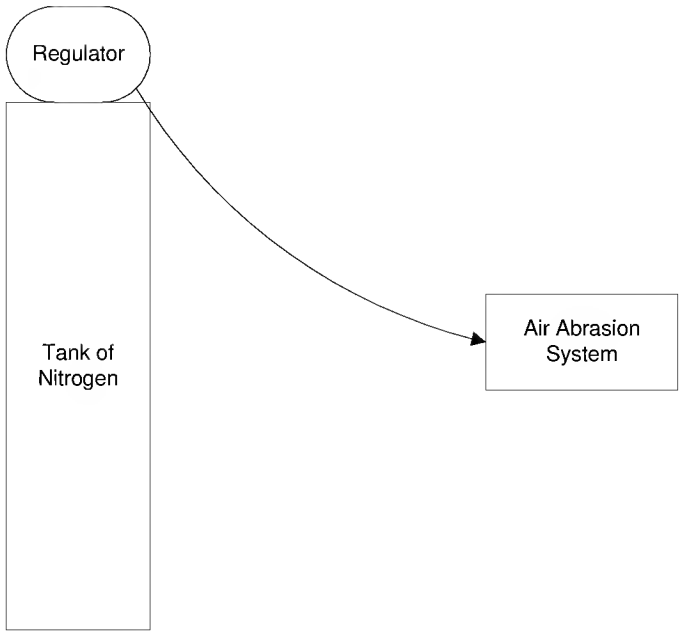


Figure 16 Using Bottled/Tanked Nitrogen

5.2 Dental Chair Pneumatic Integration Instructions Mach 5.0 and Mach 5.0 Plus

5.2.1 Chair Integration Kit (P/N 170068)

Air Supply Hose Assembly (P/N 170067) Mach 5.0 only

- 1 hose assembly 20 feet long with female quick connect
- 1 Tee fitting
- 3 tubing clamps
- 1 reducing fitting (used as needed)

Pneumatic Footswitch Hose Assembly (P/N 170069)

- 1 hose assembly with a male quick connect
- 1 Tee fitting
- 2 tubing clamps

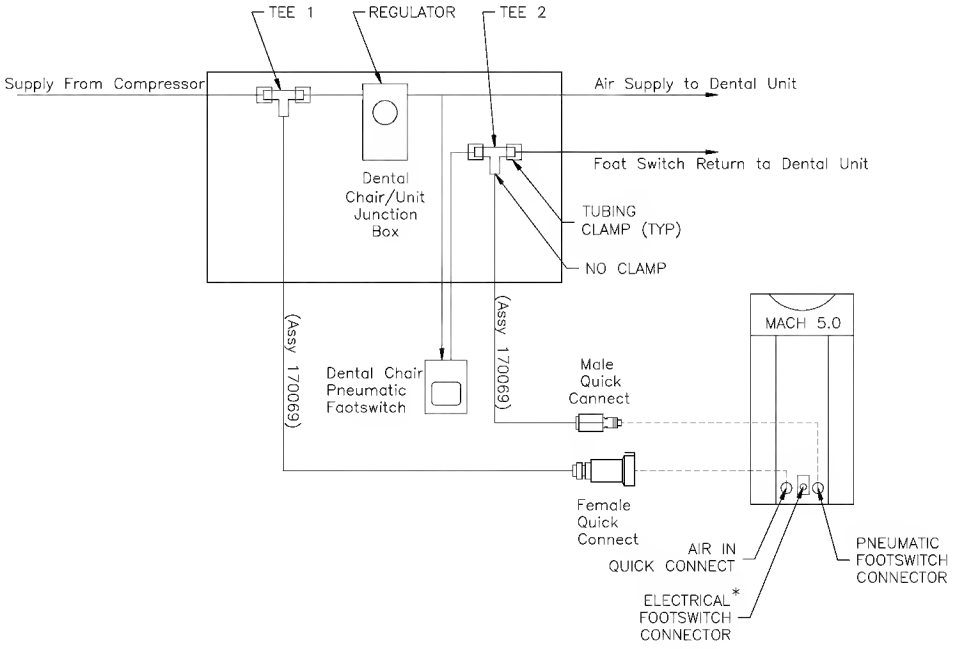


Figure 17 Chair Integration Kit (P/N 170068)

5.2.2 Installation instructions

1. Locate the pneumatic lines connected to the dental chair footswitch.
2. Repeatedly press and release the dental chair pneumatic footswitch while holding the pneumatic lines. The tube you feel pulsing is the Footswitch Return Line; mark it for later reference (step 6).
3. Close the valve from the office compressor to the dental chair/unit, and bleed pressure from the line.
4. Install Tee 1 on the line from the compressor to the dental unit before the regulator (for Mach 5.0 only).
5. Install the hose assembly with the Female Quick Connect from Tee 1 to the Mach 5.0 Air In Quick Connector port.

6. Install Tee 2 on the Footswitch Return Line from the pneumatic footswitch.
7. Install the hose assembly with the Male Quick Connect from Tee 2 to the Mach 5.0 Pneumatic Footswitch Connector.
8. Open the valve from the compressor to restore pressure to the dental chair/unit.
9. Check new connections for leaks.
10. *Disconnect the electrical footswitch from the back of the Mach 5.0 unit to avoid accidental activation.

5.3 Pneumatic Footswitch Adapter Installation Instruction

5.3.1 Pneumatic Footswitch Adapter Kit (P/N 140045)

- Pneumatic Footswitch Adapter box (P/N170199)
- Interconnect tubing assembly (P/N170206)

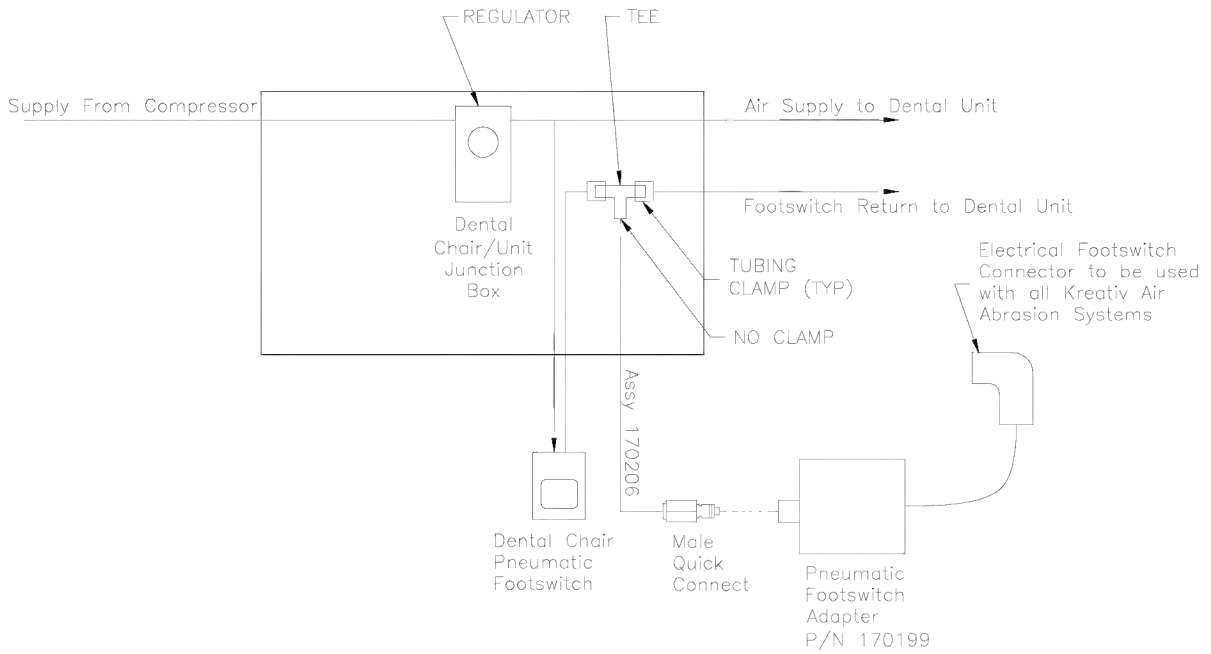


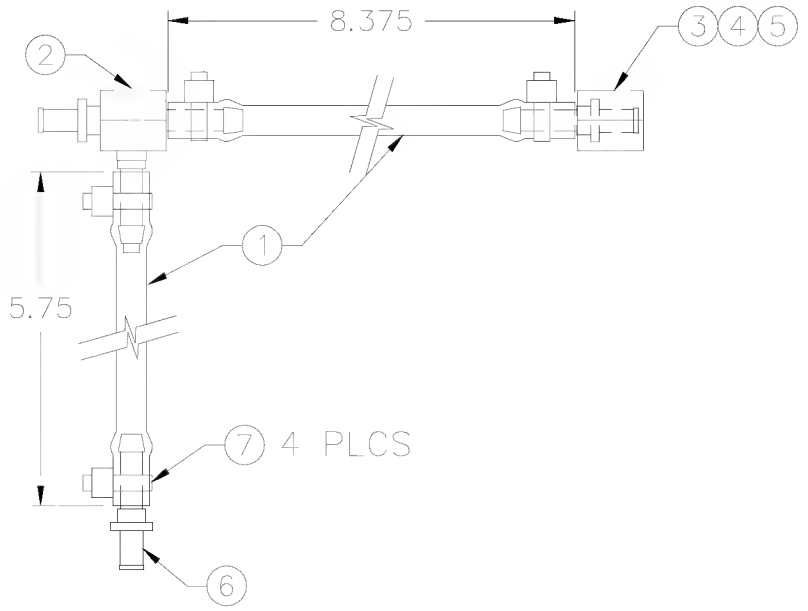
Figure 18 Multiop Integration Kit (P/N 140045)

5.3.2 Installation Instructions

1. Locate the pneumatic lines connected to the dental chair pneumatic footswitch.
2. Repeatedly press and release the dental chair footswitch while holding the pneumatic lines. The tube you feel pulsing is the Footswitch Return Line; mark it for later reference (step 4).
3. Close the valve from the office compressor to the dental chair/unit and bleed pressure from the line.
4. Install the Tee to the Footswitch Return Line from the pneumatic footswitch.
5. Route interconnect tubing assembly from the Tee to the Pneumatic Footswitch Adapter Box. Install the male quick disconnect into the Pneumatic Footswitch Adapter. Locate the electrical connector attached to the Adapter Box and connect it to the electrical footswitch input on the air abrasion instrument.
6. Open the valve from the compressor to restore pressure to the dental chair/unit.
7. Check new connections for leaks.

6. Upgrade/Instruction Procedures

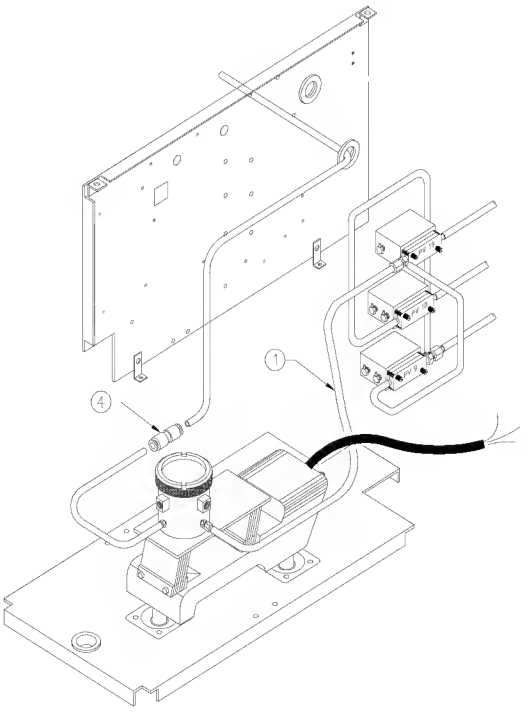
6.1 Tubing Upgrade

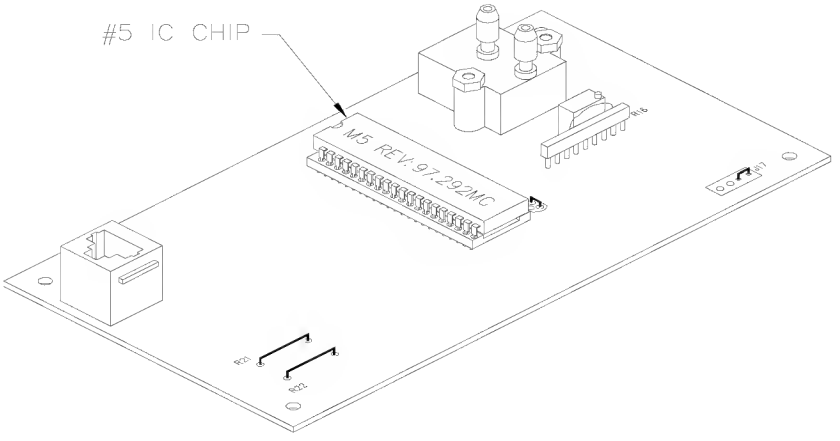


Reference Number	Part Number	Description
1	390008	Tubing .095" x .4" black
2	170138	Tee Billet Assembly
	K01-00172-1	Nipple Fitting Assembly
6	K99-00100-1	Cable Tie, Self Locking .091" # 18

Figure 19 150020 BOM and 970072 MAP

6.2 Complete Burp Upgrade





Reference Number	Part Number	Description
1	150020	Tee and Hose Assembly
5	960005	"292" Software
4	360024	Connector Straight Union

Figure 20 Complete Burp Enhancement Kit (P/N 150021) and BOM

6.3 Technical Service Calibration Instruction

6.3.1 Tools Required

Digital volt meter	Crescent wrench
Micro screwdriver, slotted	90° screwdriver
Anti-sabotage lacquer compound	Short slotted screwdriver
Frequency Feeder Stroke Gauge (label)	Test jig (test switch)
7mm deep socket	13 mm wrench & deep socket
Large & small standard Phillips screwdrivers	NIST air pressure gauge 0-200 PSI, 2 PSI increments

6.3.2 Setting the Power Supply Voltage

Power supply voltage to the Main Control Board is 5.65 +/- (.01 volt). A white adjustment screw on the Power Supply Board is available if the voltage is incorrect. The adjustment screw is located on the upper right hand corner (old panel) or the upper left hand corner (new panel).

1. Set the digital volt meter on DC voltage. Measure the voltage on the Main PCA (J11A) by placing the black lead (ground) on the center black wire lead and the red lead (hot) on the outside orange wire lead. Adjust the screw if necessary.
2. Apply anti-sabotage lacquer compound to the set screw after the voltage is set.

6.3.3 Setting the Compressor Regulator

The compressor should cut in (turn on) at 125 PSI and cut out (turn off) between 147 PSI and 160 PSI to function correctly. To ensure that the compressor is set properly, use a pressure gauge calibrated to NIST standards. Do not depend on the pressure gauge supplied by the compressor manufacturer because the Kreativ factory has found that these gauges are not accurate.

1. With the Mach 5.0 Plus turned ON, turn the Accumulator Tank Shut Off Valve clockwise and close completely.
2. Remove the Accumulator Outlet Air Hose (red) from the push fitting. (Push back on the push fitting and pull the hose simultaneously to release).
3. Insert the calibrated air pressure test gauge (the gauge should be retrofitted with ¼" OD hose) to the Accumulator Outlet push fitting.
4. Turn the Accumulator Shut Off Valve counterclockwise and open completely.
5. The calibrated air pressure gauge should read between 147 and 160 PSI.
6. To ensure that the compressor turns on at 125 PSI, slowly release pressure by pulling back on the Safety Pressure Relieve Valve. (The Safety Pressure Relieve Valve is located just below the ON/OFF/AUTO switch cover and may be of two configurations: a stem style or a ring style). Observe the calibrated pressure gauge carefully, and monitor when the compressor turns on. If the compressor turns on at 125 PSI or above, the compressor is regulated properly. Go to step 12. If the compressor turns on below 125 PSI, further adjustments are required.
7. If the compressor turns on below 125 PSI, adjustments need to be made to the Pressure Adjustment Springs, located inside the ON/OFF/AUTO switch box. To access the switch box, tilt the Compressor Accumulator Tank and remove the switch box cover.
8. To remove the Compressor Accumulator Tank, remove two 13 mm bolts at the bottom of the compressor using a 13 mm wrench and 13 mm deep socket.
9. Tilt the switch box outward until the cover can be removed. Note: A small Phillips screw holds the cover on.
10. After the cover is removed, two adjustment springs are visible. (WARNING: Extreme caution should be used as line voltage terminals are exposed.) With a 7 mm wrench, individually adjust each nut one

rotation until the compressor turns on at 125 PSI. NOTE: It is important that the springs remain equal. When the compressor turns on at 125 PSI, the Compressor Pressure Switch is set properly.

11. Replace the cover on the switch box and mount the Accumulator Tank to the Mach 5.0 Plus chassis.
12. Turn the Accumulator Tank Shut Off Valve clockwise, closing completely.
13. Remove the pressure gauge from the push fitting, and re-install the hose (red).

6.3.4 Setting the System Regulator

The System Regulator should be set at 130 PSI. The System Regulator is located on the electronic side of the Mach 5.0 Plus, mounted on the left side of the frame. NOTE: Do not mistake the System Regulator with the Pinch Valve Regulator which is mounted just above the System Regulator on the center mounting panel.

1. To check the System Regulator's pressure, turn the Accumulator Tank Shut Off Valve clockwise to close.
2. Remove the hose (red) from the input side of the Main Air Solenoid (Mac Valve). The Main Air Solenoid (Mac Valve) is located center on the bottom of the mounting panel. The hose is attached with a push-style fitting.
3. Insert a NIST test gauge into the output side of the System Regulator.
4. Turn the Accumulator Tank Shut Off Valve counterclockwise to open.
5. On the test gauge, the pressure should read 130 PSI. If not, adjust the regulator by pulling up the knob and turning it clockwise to increase the pressure or counterclockwise to decrease the pressure until 130 PSI registers. Push down on the System Regulator to set.
6. Place a small amount of anti-sabotage lacquer compound on the top of the System Regulator to identify that the regulator has been set.

6.3.5 Setting the Pinch Valve Regulator.

1. With the unit in the ON position, set the Remote Control to 120 PSI (Particle Energy).
2. Pull up the Pinch Valve Regulator knob and turn the knob counterclockwise until air leaking from the Exhaust Bottle is apparent.
3. Cycle the footswitch a few times, and turn the regulator clockwise until the air leak disappears. Cycle again to ensure that no air leaking is apparent.
4. Turn the regulator clockwise one full rotation. Close the regulator by pushing down the knob to lock it into position.
5. Apply anti-sabotage lacquer compound to identify that the Pinch Valve Regulator is set.

6.3.6 Setting the Main Control Board Pressure Transducer

The Pressure Transducer on the Main Control Board and the Remote Control pressure display (Particle Energy) should match. The Pressure Transducer is located at SEN1 on the Main PCA.

1. Using a calibrated air gauge, tee into the hose supplying air to the Pressure Transducer. The calibrated air gauge will have to be installed with ¼" OD tubing and set up with a push union on the end of the hoses so that the pressure gauge can be installed in line. NOTE: The hose supplying the Pressure Transducer air pressure will have either a lure fitting and a brass Tee **or** a push union and a brass Tee. Current production equipment is equipped with a push Tee fitting. If the equipment has either the lure/brass Tee or push union, replace it with a Tee push fitting. The hose from the Pressure Transducer may also need to be replaced if the hose length is not adequate for the Tee push fitting.
2. Set the Remote Control at 60 PSI (Particle Energy). If the Remote Control and gauge air pressure match, cycle the footswitch a few times to ensure that pressure resumes shortly after the footswitch is cycled.

3. Cycle the footswitch a few times to ensure that the pressure is accurate. Repeat at 40, 80, and 120 PSI. Adjust the screw if necessary. Also, switch between the Standby and On positions a few times, ensuring that the pressures match. Turn the unit ON and OFF a few times to ensure that the pressure remains equal on the Remote Control and the pressure gauge.
4. If the pressures do not match, turn the adjustment screw, located on the Main PCA (blue potentiometer with very small adjustment screw). Turn in either direction until both the Remote Control and the pressure gauge match.
5. Apply anti-sabotage lacquer compound to the adjustment screw when it is calibrated correctly.

6.3.7 Setting the Vibrator

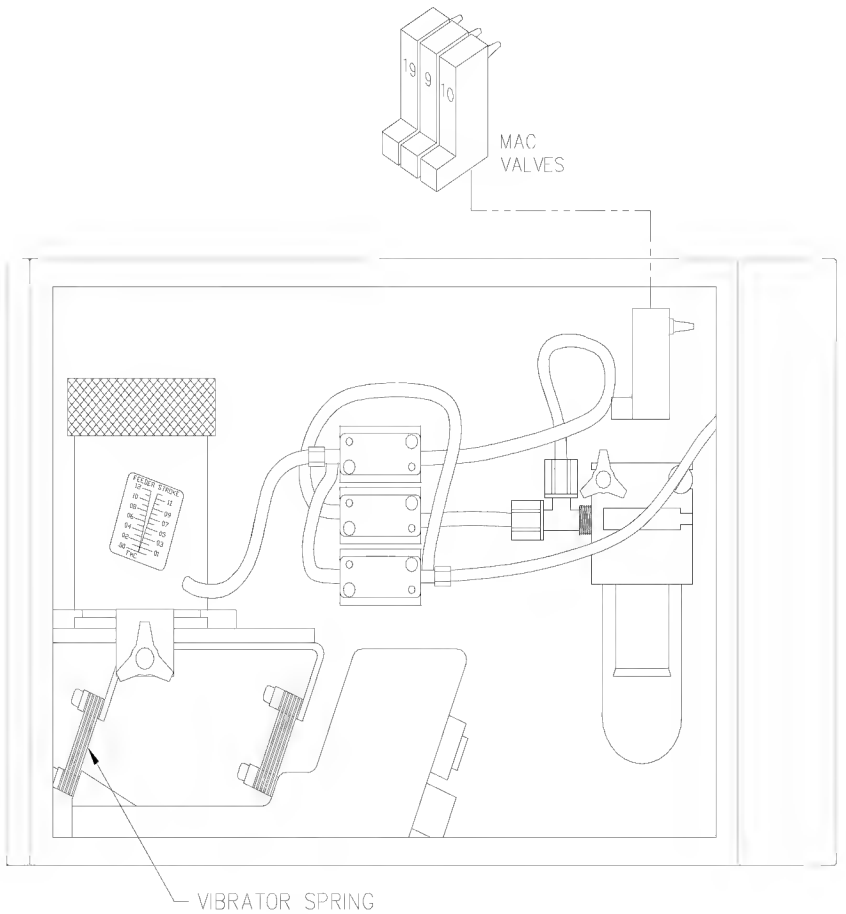


Figure 21 Stroker Gage Placement

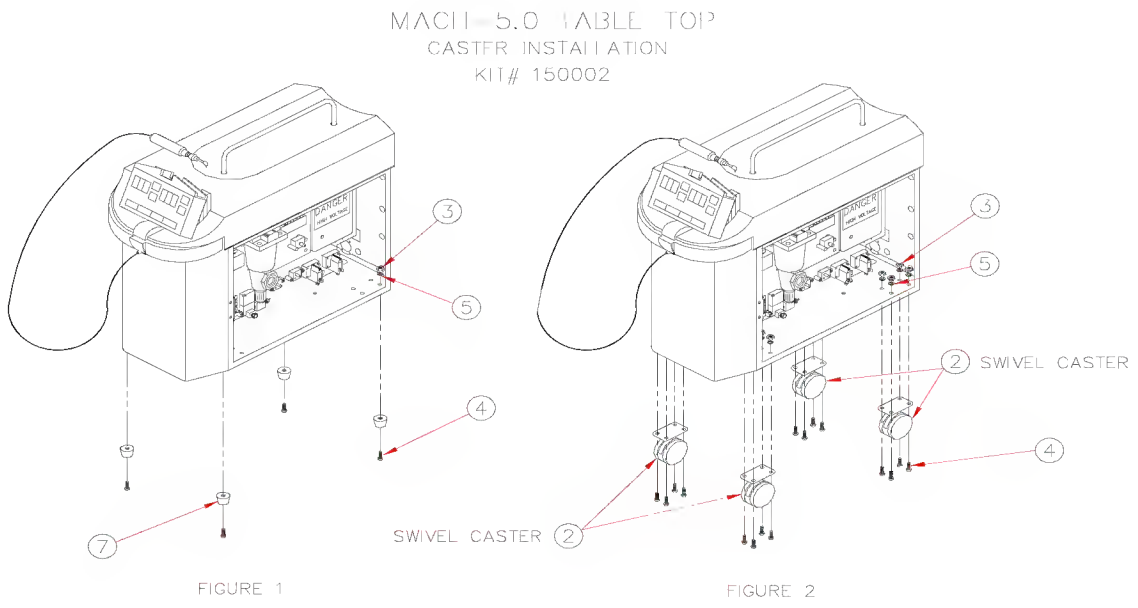
1. Plug the jig (test switch) into J1 on the Main PCA. If no test switch is available, order one from the factory as soon as possible. If the unit needs the Vibrator set and the test switch is not available, set up the *KlearAir* system and place the handpiece hose directly into the *KleanAir* hose assembly. (Ensure that the handpiece is connected to the handpiece hose).

2. Place the Frequency Feeder Stroke Gauge on the center of the Mixing Chamber, ensuring that the graduated lines on the gauge are parallel with the line of drive. (See Figure 21.)
3. Fill the Powder Canister 7/8 full of powder.
4. With the machine in the ON position, set the Beam Intensity to "10" on the Continuous mode.
5. Close the test switch or turn ON the unit and press the footswitch. The frequency gauge should read .02 if the Vibrator frequency is correct. NOTE: The peak of the spike should match with the line at .02.
6. If the Vibrator frequency is incorrect, loosen the lock nut on the Vibrator and adjust the large set screw (a large washer or quarter can be used to make the adjustment) until the Vibrator frequency is correct. Tighten the nut. NOTE: The Vibrator should be on during the adjustment of the set screw (this maintains a proper air gap and angle). A small adjustment will make a large difference. Turning the adjustment screw clockwise will increase the frequency and turning counterclockwise will decrease the frequency.

6.4 Mach 5 Caster Installation Kit

6.4.1 Tools:

- Phillips screwdriver
- wrench



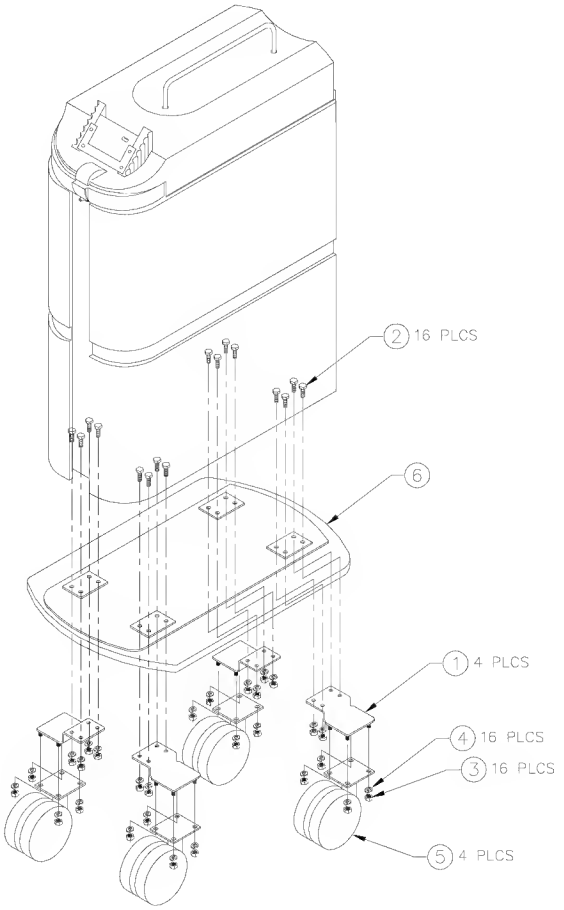
Reference Number	Part Number	Description
2	480009	Caster Swivel
3	K99-00221-5	Nut 10/32”
4	310016	Screw
5	K99-00289-1	Washer # 10

Figure 22 Mach 5.0 Caster Option Kit and Instructions (P/N 150002) and BOM

6.4.2 Caster Installation Instructions:

1. To replace the standard bumper package for the Mach 5.0 table top with the optional caster package, lay the Mach 5.0 on its side on a soft cloth. Open the doors wide enough to access the caster nuts inside the frame weldment. NOTE: Do not allow the door to open fully while on its side: this would allow all the door weight to rest fully on the hinge, causing it to fail.
2. With the unit on its side, remove the top two bumpers (item 7). Install the casters, using the bolts provided with the kit, (see Figure 2 within Figure 22). Make sure that all nuts and bolts are tight, using a Phillips screwdriver and a 7/16” wrench.
3. With the casters in place, close the door, turn the unit over to the opposite side, and repeat step 2.

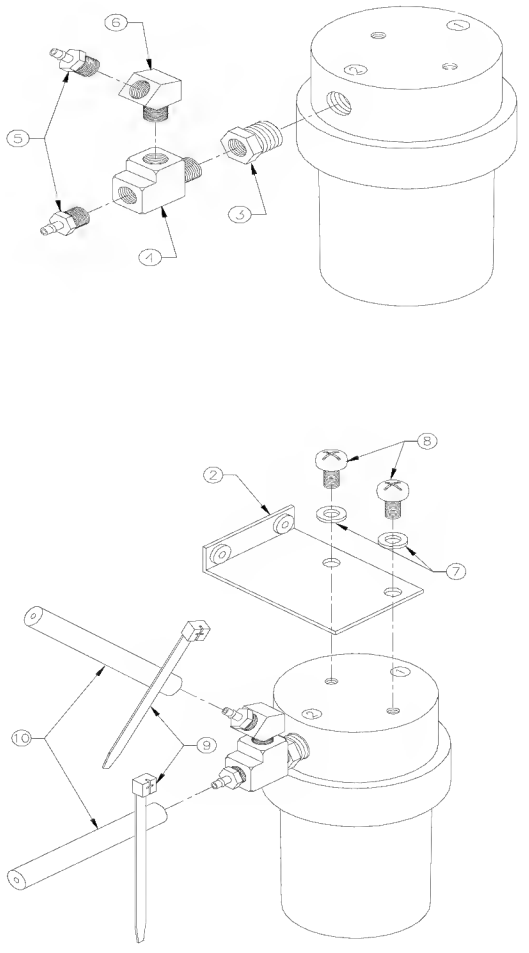
6.5 Mach 5.0 Plus Caster and Skirt Installation



Reference Number	Part Number	Description
1	210086	Bottom Skirt
2	210087	Caster Bracket
3	320010	Bolt
4	320009	Nut
5	320003	Washer
6	480028	Caster 4”

Figure 23 Mach 5.0 Plus Caster and Skirt Upgrade (P/N 150025) and BOM

6.6 Exhaust Bottle Service Upgrade



Reference Number	Part Number	Description
1	210204	Exhaust Bottle
2	210017	Bracket, Exhaust Bottle
3	360017	Fitting Bushing
4	K99-00260-1	Fitting Pipe Thread
5	K99-00020-1	Fitting Pipe Thread
6	360037	Fitting Street Elbow
7	320003	Washer ¼" split
8	310010	Screw ¼" - 20
9	460026	Cable Tie 3/16" x 7"
10	390008	Tubing .095" x .4" Black

Figure 24 Exhaust Bottle Service Upgrade (P/N 150022) and BOM

6.7 Fitting Upgrade 150010

Reference Number	Part Number	Description
	970018	MAP, CS Upgrade Pres Reg VLV
2	K99-00200-3	Tubing, Urethane Clr 1/8" ID x ¼"
17	480023	Filter, Coalescing 99% .01 Micron
21	K99-00060-2	Wire, Black 18 AWG Style 1015
22	460007	Tubing, Heat Shrink 1/8" Dia x .5" L
26	K99-00115-1	Regulator, Air 125 PSI Relieving
27	390003	Tubing, ¼" OD N11 Nylon
28	K99-00309-1	Nut, Panel Norgren Regulator
29	210000	Bracket, Regulator
30	360018	Fitting, ¼" Tube x 1/8" NPT
31	K99-00209-7	Screw, 6/32" x 1 5/8" Phillips
32	K99-00221-3	Nut, 6/32" x ¼" Small Pattern
34	K01-00182-1	Assy, Orifice Plate 115V
35	210082	Gasket, Orifice Plate
36	340010	Clamp, Hose RER SS
37	360029	Fitting, 1/8" NPT Male Run Tee QD
38	360028	Fitting, 10/32" Male Conn QD
39	360018	Fitting, ¼" Tube x 1/8" NPT
40	360008	Fitting, Push ¼" MANPT x ¼" Push
41	360030	Fitting, 1/8" NPT Union Tee QD
42	360027	Fitting, Tee 1/16" Brass Barb
43	K99-00255-1	Fitting, 1/32" Nipple
44	360031	Fitting, 1/8" NPT M 10/32" F Elbow
45	K99-00243-1	Fitting, Brass 10/32" x 1/8" Barb
46	360031	Fitting, 1/8" NPT M 10/32" F Elbow
47	360018	Fitting, ¼" Tube x 1/8" NPT
48	360028	Fitting, 10/32" Male Conn QD
49	480022	Plug, 1/8" MPT HEX
50	K99-00259-1	Valve, Check
51	K99-00186-2	Header, Rcpt .100 Center 22 AWG 4
52	350004	Valve, Solenoid 150 PSI 3-Way
53	480022	Plug, 1/8" MPT HEX
54	K99-00186-2	Header, Rcpt .100 Center 22 AWG 4
55	960002	Assy, S/W Remote Cont 97 .117

Reference Number	Part Number	Description
56	170138	Assy, Tee Billet PV
57	K01-00165-1	Nut, QD Thded 5/16" 24
58	K01-00184-1	Assy, Fitting Nipple PV
59	K99-00014-2	Washer, Nyl .147" ID x .250" OD x .03"
60	K01-00172-1	Assy, Fitting Nipple PV
61	K99-00100-1	Tie, Cbl Self-Lkg .091" W 18# .625" B
62	960005	Assy, S/W MC VER 97.292
63	360024	Conn, .52" OD x 1.36" L Straight Union
64	200023	Assy, Guidelines at a Glance
65	K99-00270-1	Washer, #4 Lock Split
73	K99-00256-1	Fitting, 10/32" x 3/32" Barb
74	K99-00200-2	Tubing, Urethane 3/32" ID x 5/32" OD
75	K99-00200-1	Tubing, Urethane 1/16" ID x 1/8" OD
76	K99-00270-5	Washer, Lock ¼"
77	K99-00270-4	Washer, #10 Lock Split
78	K99-00221-5	Nut 10/32"
79	970086	MAP, Canister
80	990150	Inst, Rework Stppr Mtr TS
81	980063	Procedure, Calibration Mach 5.0 &5.0 Plus Tech
82	970046	MAP, Exhaust Bottle Mounting
83	970087	MAP, Panel Old New Connections
84	970085	MAP, PCA Main Remote Control
85	170173	Assy, Exhaust Btl PM Mach 5.0

6.8 Fitting Upgrade 150011

Reference Number	Part Number	Description
	970018	MAP, CS Upgrade Pres Reg Vlv
9	K99-00200-3	Tubing, Urethane Clr 1/8" ID x 1/4" OD
16	480023	Filter, Coalescing 99% .01 Micron
18	960002	Assy, S/W Remote Cont 97.117
20	K99-00060-2	Wire, Black 18 AWG Style 1015
21	460007	Tubing, Heat Shrink 1/8" Dia x .5" L
22	K99-00209-7	Screw, 6/32" x 1 5/8" Phillips
23	K99-00221-3	Nut, 6/32" x ¼" Small Pattern
25	K01-00182-1	Assy, Orifice Plate 115V

Reference Number	Part Number	Description
26	210082	Gasket, Orifice Plate
27	340010	Clamp, Hose RER SS
28	360029	Fitting, 1/8" NPT Male Run Tee QD
29	360028	Fitting, 10/32" Male Conn QD
31	360008	Fitting, Push ¼" MANPT x ¼" Push
32	360030	Fitting, 1/8" NPT Union Tee QD
33	360027	Fitting, Tee 1/16" Brass Barb
34	K99-00255-1	Fitting, 10/32" Nipple
35	360031	Fitting, 1/8" NPT M 10/32" F Elbow
36	K99-00243-1	Fitting, Brass 10/32" x 1/8" Barb
37	360031	Fitting, 1/8" NPT M 10/32" F Elbow
38	360018	Fitting, ¼" Tube x 1/8" NPT
39	360028	Fitting, 10/32" Male Conn QD
40	480022	Plug, 1/8" MPT HEX
41	K99-00259-1	Valve, Check
42	K99-00186-2	Header, Rcpt .100 Center 22 AWG 4
43	350004	Valve, Solenoid 150 PSI 3-Way
44	170138	Assy, Tee Billet PV
45	K01-00165-1	Nut, QD Thded 5/16" 24
46	K01-00184-1	Assy, Fitting Nipple PV
47	K99-00014-2	Washer, Nyl .147" ID x .250" OD x .03"
48	K01-00172-1	Assy, Fitting Nipple PV
49	K99-00100-1	Tie, Cble Self-Lkg .091" W 18# .625" B
50	960005	Assy, S/W MC VER 97.292
51	360024	Conn, .52" OD x 1.36" L Straight Union
52	200023	Assy, Guidelines at a Glance
53	K99-00270-1	Washer, #4 Lock Split
62	K99-00256-1	Fitting, 10/32" x 3/32" Barb
63	K99-00200-2	Tubing, Urethane 3/32" ID x 5/32" OD
64	K99-00200-1	Tubing, Urethane 1/16" ID x 1/8" OD
65	K99-00270-5	Washer, Lock ¼"
66	K99-00270-4	Washer, #10 Lock Split
67	K99-00221-5	Nut, 10/32"
68	980063	Procedure, Calibration Mach 5.0 & 5.0 Plus Tech
69	990150	Inst, Rework Stppr Mtr TS
70	970086	MAP, Canister

Reference Number	Part Number	Description
71	970046	MAP, Exhaust Bottle Mounting
72	970087	MAP, Panel Old New Connections
73	970085	MAP, PCA Main Remote Control
74	170173	Assy, Exhaust Btl PM Mach 5.0

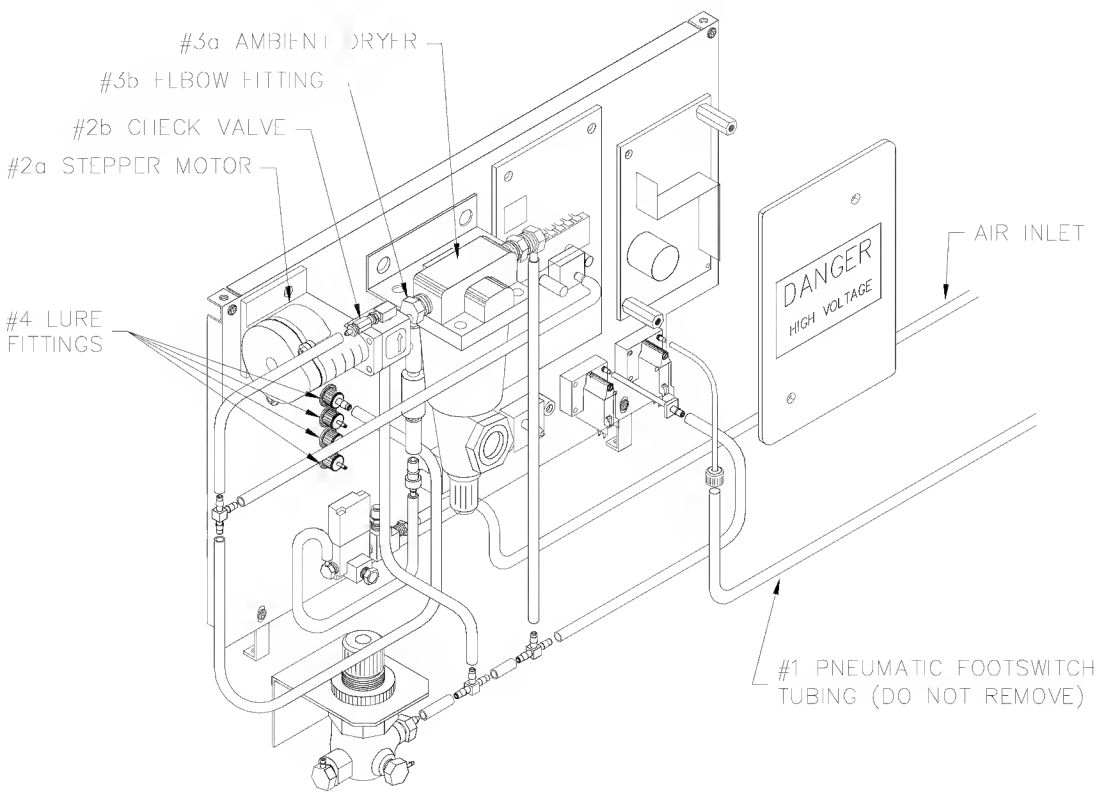


Figure 25 Fitting Upgrade MAP and BOM

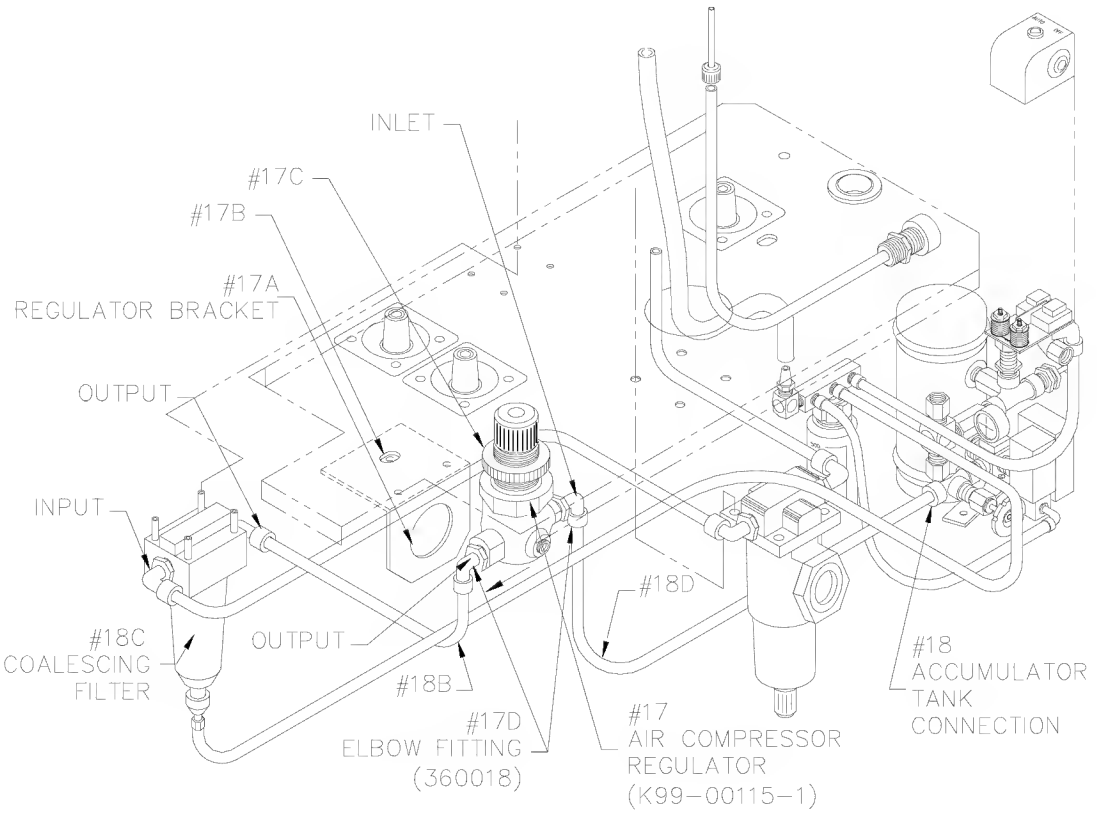


Figure 26 Fitting Upgrade MAP and BOM

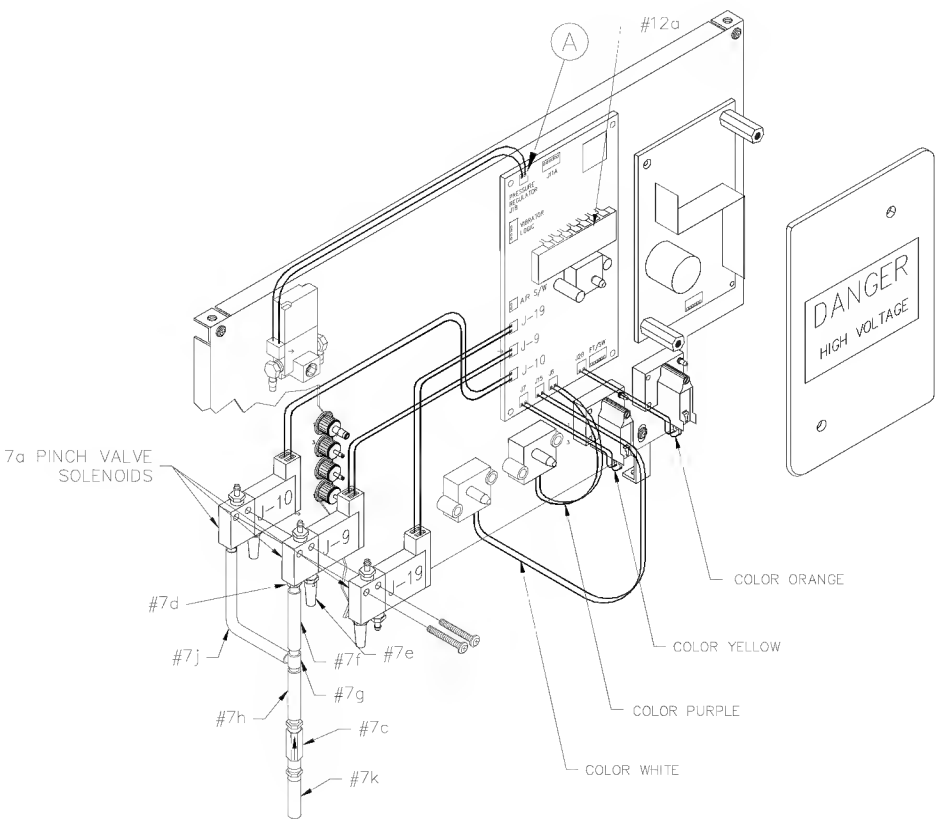


Figure 27 Fitting Upgrade MAP and BOM

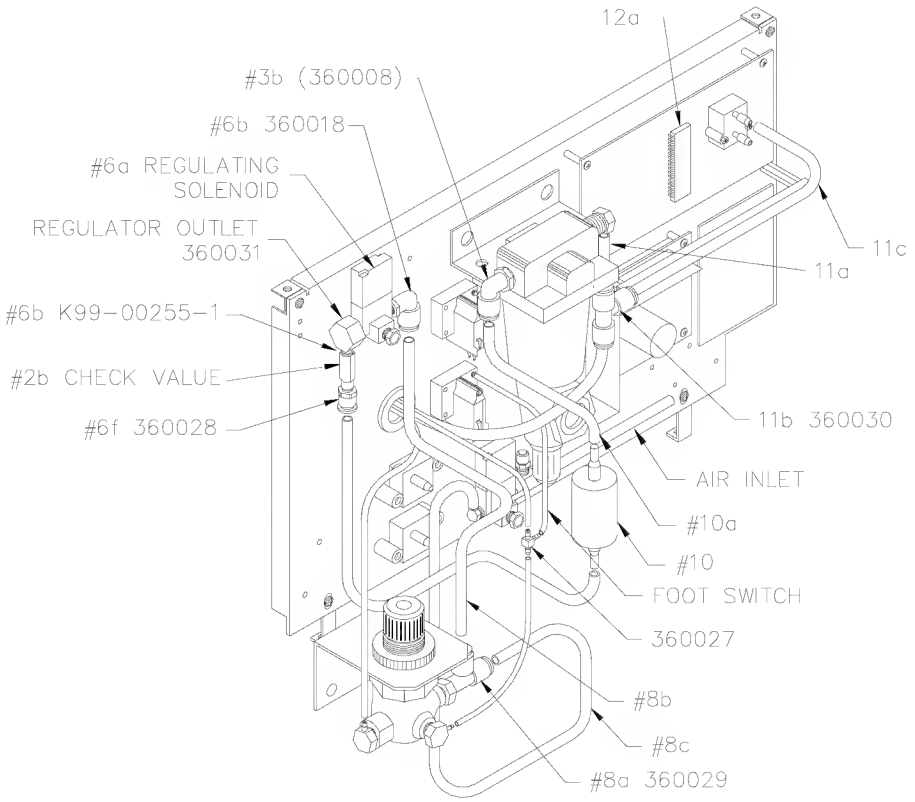


Figure 28 Fitting Upgrade MAP and BOM

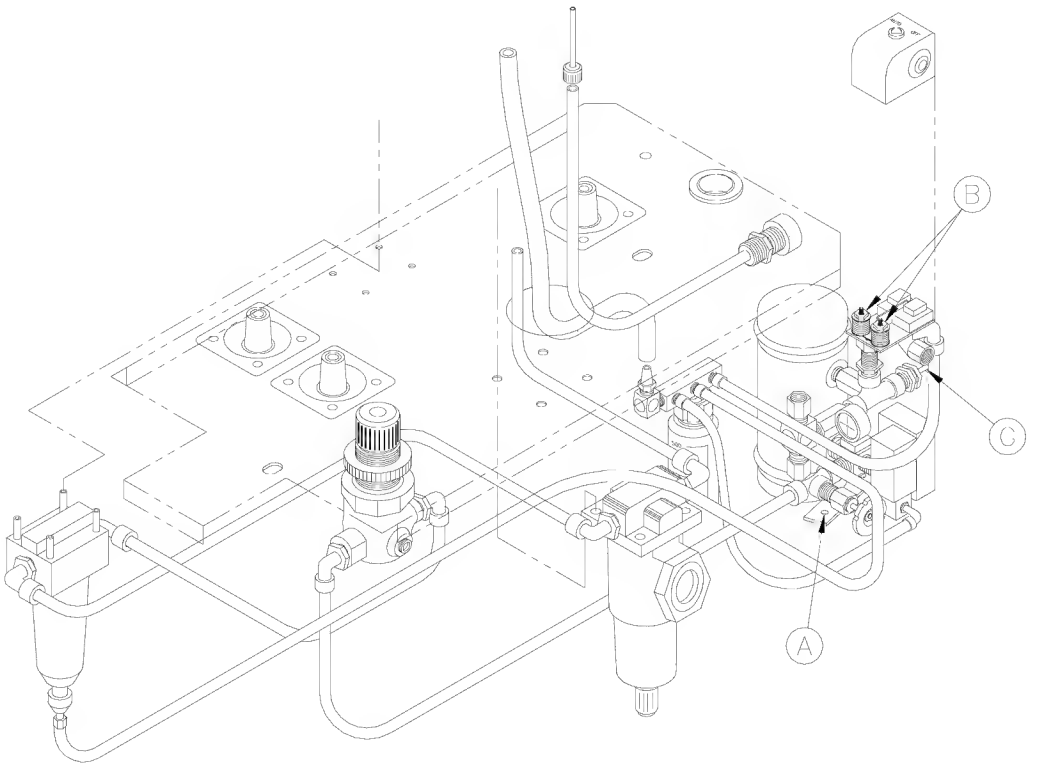


Figure 29 Fitting Upgrade MAP and BOM

6.9 TECHNICAL SERVICE STEPPER MOTOR REWORK INSTRUCTIONS

6.9.1 Tools Required

Small side cutters	8" or 10" crescent wrench
Small needle nose pliers	IC chip puller
9/16", 7/16", and 5/16" box end wrenches	Calibration 5/32" allen wrench
Phillips screw drivers; standard and stubby	See Tools Required for Calibration

6.9.2 Maps and Diagrams required

970018	MAP, Regulator Change Out
980085	MAP, Remote Control
980086	MAP, Canister
980087	MAP, Fitting Upgrade
970079	MAP, QD Fitting and Plumbing Replacement Service
980063	MACH 5 and 5.0 Plus Calibration Instructions

6.9.3 Procedures

NOTE: All # references are for MAP 970018 unless otherwise stated. Figure #s are for Service Manual reference only.

CAUTION: Care should be used when removing tubing from fittings as some of the fittings may need to be reused.

1. Remove all hoses except for the Pneumatic Footswitch Air In Pressure Sensor (see #1 and Figure 25), located on the electronic side of the Mach 5.0 and 5.0 Plus in the lower far right hand corner, and the clear tubing ID x ¼" OD on pinch valve J10, and the black super hose on pinch valve J9 to bulkhead fitting. The pinch valve tubing is located on the Mixing Chamber side.

2. Remove Stepper Motor (see #2a and Figure 25) from the mounting panel (two Phillips screws). Discard the Stepper Motor, and save the check valve (see #2b and Figure 25).

3. Remove the Ambient Dryer (see #3a, sheet 3, and Figure 25, two Phillips screws on bracket), located on the electronic side of the Mach 5.0 and 5.0 Plus fastened to the center of the mounting panel. Remove and discard the elbow fitting from the left side of the Dryer using a 9/16" wrench. Replace it with a threaded elbow push fitting (see #3b, P/N 360008, and Figure 25).

4. Remove and discard the bulkhead lure fittings (see #4 and Figure 25), located on the center bulkhead to the left of the Ambient Dryer. The nuts holding the fittings in place are located on the Ambient Dryer side of the mounting panel.

5. Remove the Exhaust Bottle and bracket (see #5a, sheet 7), and the hoses from PV19 and PV10 (Mixing Chamber side). DO NOT discard the mounting hardware. Mount the replacement Exhaust Bottle and bracket using one of the Phillip screws (attach from the electronic side). Install only the left screw at this time. The right side is used to mount the Regulating Solenoid. Insert the nipples into the top two pinch valves, and loosely secure the covers.

6. The Regulating Solenoid (see #6a, sheet 3, and Figure 28) will attach where the Stepper Motor was located. A hole will need to be drilled on the left side. Holding the Regulating Solenoid up to the mounting panel, mark the mounting panel where the hole will need to be drilled. Drill a 9/64" hole through the panel and through the bracket. Before attaching the solenoid valve, thread an elbow push fitting (see #6b, P/N 360018, sheet 3, and Figure 28) to the right side of the solenoid. Attach an 1/8" x 10/32" brass elbow fitting (see #6c, P/N 360031, sheet 3, and Figure 28) to the left side of the solenoid valve. NOTE: Use Hydraulic Sealant (K99-00297-1) on the threads of the elbow fitting.

   Attach an adapter fitting (see #6d, P/N K99-00255-1, sheet 3, and Figure 28); then add the check valve, saved from the Stepper Motor, (see #2b and Figure 28). Ensure that the arrow is pointing down. Add a male 10/32" push fitting (see #6f, P/N 360023, Sheet 3, and Figure 28) to the check valve.

   NOTE: The Regulating Solenoid should come from the factory assembled with extension wires and a connector. If not, the solenoid will need to be retrofitted with 22 gauge wire leads and a 4 pin connector. A crimp tool and heat gun are required for this procedure. Trim the wire leads on the solenoid valve to 9". Solder a 3" piece of 22 gauge wire (P/N K99-00060-2) to the existing leads. Slide a 1" piece of heat shrink over the exposed wires. Use the heat gun to adhere the heat shrink to the wire insulation. Attach the wire leads to a 4 pin connector by sliding one of the wire leads into the first slot on the crimp tool; squeeze the lever. Place the other wire lead into the second slot on the crimp tool.

   Attach the solenoid valve (see #6a and Figure 28) to the mounting panel with two 6/32" x 1 5/8" screws (P/N K99-00209-7) and two lock washers #4 (P/N K99-00270-1) and one 6/32" nut (P/N K99-00221-3). NOTE: The right side of the solenoid valve does not need the lock washers or nut since the pemnut on the mounting panel is used.

   Connect the wire leads (see #6h, sheet 4) to the Main PCA, location J18.

7. Remove all three of the pinch valve solenoids (see #7 and Figure 27) from the mounting panel, attached by two Phillips screws. The pinch valve solenoids are stacked and mounted on the left hand side of the

electronic side of the Mach 5.0 and 5.0 Plus. NOTE: Do not unstack the solenoid valves, and do not remove the wire leads from the Main PCA.

Use one of the Phillips screws to maintain the configuration. Remove the check valve from the bottom of J9 (middle) solenoid, and save. Replace it with a threaded reducing barbed fitting (K99-00256-1). Then remove the muffler, and replace with the check valve that was just removed. Attach the 3" tubing 3/32" ID x 5/32" OD (P/N K99-00200-2) to the barbed fitting. Attach the Tee fitting (P/N 360030), and add 3" pieces of tubing to both open barbs. On the Tee section of the barb, connect tubing to the bottom barb on J9. Then connect the check valve to the other loose end, ensuring that the arrow is pointing up toward the top of the machine. Add another 3" piece of tubing 3/32" ID x 5/32 OD to the check valve. Then connect the 3" tubing to the output (left side) of the System Regulator. The Pinch Valve Regulator is mounted on a bracket just below the pinch valve solenoids. Re-attach the pinch valve solenoids to the mounting panel, carefully ensuring that J19 solenoid is mounted furthest from the mounting panel and that the wire leads connect to the Main PCA at J19 location. J9 solenoid is in the middle and J10 is closest to the mounting panel.

Connect a 6" piece of tubing 1/16" ID x 1/4" OD (P/N K99-00200-1) to the bottom barbed fitting on the front solenoid valve, J19 (see #7h, P/N 970079, and Figure 27). Attach a Tee fitting (see #7j, P/N 970079, and Figure 27). Add a 2.5" piece of tubing 1/16" ID x 1/8" OD to the Tee side of the fitting and connect to the front barbed fitting on the Pinch Valve Regulator (see #7k, P/N 970079, and Figure 27). Connect an 11" piece of tubing 1/16" ID x 1/8" OD (see #7l, P/N 970079) to the remaining port on the Tee. Connect the tubing to the Pressure Sensor Nipple (see #7a and Figure 27), located on the electronic side on the bottom, hand corner. NOTE: There are two pressure sensors, one to the far right and one just left of the far right. Connect the tubing to the pressure sensor just left of the far right one. Be careful of the pressure sensor nipple, because it is fragile. When installing the hose, apply soapy water to the nipple for ease of installation.

Connect a tubing 1/16" ID x 1/8" OD" (P/N K99-00200-1) to the elbow fitting on pinch valve J19 (J19 is the top pinch valve and is mounted on the Mixing Chamber side, just left of the Exhaust Bottle. Connect the tubing to the elbow fitting on the left hand side of the pinch valve (see #7n). Route above the pinch valve and through the second bulkhead lure lock hole and connect to the top barb on the first pinch valve solenoid (see #7c and Figure 27). The tubing should be approximately 11" long. Connect another piece of 1/16" ID x 1/8" OD tubing to the elbow fitting on pinch valve J10 (see #7p), located just below pinch valve J19. Route above the pinch valve, through the third hole, and connect to the top barb on the solenoid valve closest to the mounting panel (see #7g and Figure 27). Connect another piece of 1/16" ID x 1/8" OD tubing to the elbow fitting on pinch valve J9 (see #7r). Route above the pinch valve, through the fourth hole, and connect to the top barb on the middle solenoid valve (see #7e and Figure 27).

8. Remove the brass nipple and brass Tee on the input side of the Pinch Valve Regulator (see #8), and replace with a threaded push fitting 1/8" NPT male run Tee (see #8a, P/N 360029 and 970079, and Figure 28). Ensure that the "T" is facing upwards. Attach a 4.5" piece of tubing 1/8" ID x ¼" OD (P/N K99-00200-3) to the Tee and connect the other end to the elbow push fitting (see #8b, P/N 970079, and Figure 28) on the right hand side of the solenoid valve. Attach an 8" piece of tubing 1/8" ID x ¼" OD to the remaining port on the Tee fitting, and connect the tubing to the Main Air Solenoid Valve (see #8c, P/N 970079, and Figure 28), ensuring that the tube is routed in a service loop. Use a tubing clamp to secure the tubing to the solenoid fitting. Slide the clamp on the tubing before attaching to the fitting. After the tubing is attached, slide the tubing clamp over the barbed fitting. NOTE: The Main Air Solenoid Valve is located at the bottom center on the electronic side of the Mach 5.0 and 5.0 Plus.

9. Reconnect the Ambient Dyer to the mounting panel.

10. Attach one end of the Coalescing Filter (see #10 and Figure 28) to a 2" tubing 1/8" ID x ¼" OD (P/N K99-00200-3), ensuring that the arrow on the Coalescing Filter is pointing toward the top of the machine. Secure the tubing to the Coalescing Filter with a tie wrap, and attach the tubing to the elbow push fitting on the left hand side of the Ambient Dryer.

Attach a 13 ½" piece of tubing 1/8" ID x ¼" OD (see #10b, P/N K99-00200-3) to the other end of the Coalescing Filter. Secure the tubing to the Coalescing Filter with a tie wrap. Let the open end tubing dangle for the time being.

11. Attach a 1 1/2" piece of tubing 1/8" ID x ¼" OD (P/N K99-00200-3) to the remaining barbed fitting on the right hand side of the Ambient Dryer (see #11a and Figure 28) with a tubing clamp (P/N K99-00283-1). Slide the clamp onto the tubing before attaching to the fitting. After the tubing is attached, slide the tubing clamp over the barbed fitting.

    Attach a ¼" x ¼" push style Tee fitting (see #11b, P/N 360030, and Figure 28) to the open end of a 1.5" piece of tubing. Cut a 6" piece of tubing 1/8" x ¼" OD, and attach to the Tee section of the push fitting. Attach an open end of tubing to the Pressure Transducer's center nipple on the Main PCA (see #11c and Figure 28). Secure the tubing with a tie wrap.

    NOTE: The Pressure Transducer is fragile. Use extreme care when attaching the tubing. Attach a 24" piece of tubing 1/8" ID x ¼" OD (K99-00200-3) to the remaining port on the push Tee fitting. Route behind the Ambient Dryer through the top lure fitting hole. The tubing should route between the bottom and middle pinch valves behind the Mixing Chamber and attach to the brass fitting (air inlet) on the Mixing Chamber (#11d). Secure with a tubing clamp.

12. Install the Burp Upgrade Kit (P/N150021). Using the ESD strap provided in the kit, ground the strap to the unit. With the power in the OFF position and the machine unplugged, remove the Main Control IC chip with an IC chip puller. The IC chip is located on the Main PCA assembly near the center of the board on the electronic side of the Mach 5.0 and 5.0 Plus (see #12a, and Figure 28). The chip will have a label attached which will read M5 REV 358 MC. Replace with chip M5 REV 292 MC.

    NOTE: The IC chip has a crescent-shaped half moon on one end and the Main control board also shows a crescent-shaped half moon on it. Ensure that the IC chip is installed with the moons matching. Use caution when installing the IC chip since the prongs are very fragile.

13. Remove the IC chip from the inside of the Mach 5.0 and 5.0 Plus Remote Control. The Remote Control is the component mounted on the front of the outside of the machine. Disconnect the RJ45 connector (it resembles a telephone cord connector) from the back of the Remote Control. Remove the back cover of the Remote Control by unscrewing the four Phillips screws. Remove the IC chip labeled M5 REV 358 RC. Replace with the IC chip labeled M5 REV 117 RC, again matching the crescent half moons on the chip and the Main PCA board (see #13a, 970085). NOTE: The IC chip possibly could already be M5 REV 117 RC.

14. In the kit is a union fitting; discard it. Also, in the kit is a pre-assembled super hose assembly (see #17, 970018 Rev. B, and Figure 26). The threaded nut connects to the fitting on the output side of the Mixing Chamber. NOTE: The threaded nut has a small nylon washer included which is taped. The Tee connection inserts into the top left pinch valve, and the nipple fitting inserts into the bottom left pinch valve.

15. Remove the old orifice plate assembly from the Mixing Chamber. To remove Mixing Chamber, turn the star knob counterclockwise to loosen the retaining block. Turn the Mixing Chamber upside down to reveal three 5/32" allen screws (see # 6, 970086). Remove the allen screws. Replace the gasket (see #10, 980086, P/N 210082, and Figure 28) and the Orifice Plate Assembly (see #4, 970086, P/N 200020).

16. If the unit is a Mach 5 Plus refer to step 17. If the unit is a Mach 5.0. See Section 6.1 and Calibration Instructions Mach 5.0 and 5.0 Plus (980063 Rev. A.).

17. An Air Compressor Regulator will need to be added to the Mach 5.0 Plus (sheet 6). Install the Air Compressor Regulator (see #17, P/N K99-00115-1, and Figure 26) with a bracket (see #17a, P/N 210000, and Figure 26). The bracket is installed on the lower half of the compressor shelf, on the upper left hand corner, using the existing mounting panel bracket screw. Attach the regulator through the center hole on the bracket (see #17b and Figure 26) , ensuring that the mounting hole is facing outward. Unscrew the regulator nut (see #17c and Figure 26), and attach to the bracket, ensuring that the outlet side of the regulator is to the left.

NOTE: The regulator should come factory assembled with threaded elbow push fittings on the input and output sides of the regulator (see #17d and Figure 26). If not pre-assembled, install the elbows (see #17d, P/N 360018, and Figure 26).

18. Remove the black tubing from the output side of the Air Compressor Accumulator Tank connection (see #18 and Figure 26) and from the input side of the Coalescing Filter connection. The Coalescing Filter is silver and is mounted on the opposite side (see #18c and Figure 26). Attach a 12" piece of red nylon ¼" tubing (see #18d, P/N 390003, and Figure 26) to the output connector on the Accumulator Tank, and connect it to the input side of the Air Compressor Regulator. Attach an 18" piece of red nylon ¼" tubing (see #18b, P/N 390003, and Figure 26) from the output side of the Air Compressor Regulator to the input side of the Coalescing Filter.
19. Calibrate the Mach 5.0 Plus using Calibration Instructions, 980063 current revision.

6.10 Technical Service Water Damaged Mach 5.0 Procedure

6.10.1 Procedure

1. Determine how much water has entered the unit. If the water is seen in the Coalescing Filter, Ambient Dryer, and hoses, the following components may need to be replaced:
    - Switch, Air Pressure Sensor (P/N K99-00199-2)
    - Valve, Pressure Relief (P/N K99-00242-1)
    - Valve, Solenoid, inlet and pinch valve (P/N K99-00238-1)
    - Filter, Coalescing (P/N 480023)
    - Valve, Solenoid, (P/N K99-00268-1)
    - Tubing, super hose (P/N K99-00404-1)
    - Tubing, 1/16" ID x 1/8" OD,clear urethane (P/N K99-00200-1)
    - Tubing, 1/8" ID x ¼" OD, clear urethane (P/N K99-00200-3)
    - Tubing, 3/8" OD x ¼" ID, clear urethane (P/N K99-00085-1)
    - Dryer, Ambient (P/N K99-00264-1)
    - Regulator, Pinch Valve (P/N K99-00115-1)
    - Assy, Mixing Chamber (P/N 170030)
    - Assy, PCB Main Board (P/N 190000)
2. Disassemble the Mixing Chamber; clean it thoroughly. Blow out the fittings on the bottom of the chamber. Replace the orifice gasket (P/N 210086). If the powder has hardened, replace the entire Mixing Chamber (P/N 170030).
3. Disassemble all the pinch valves; clean, lubricate and re-assemble them.
4. Disassemble the Exhaust Bottle. Dry and/or replace the filter if necessary.
5. If Main PCB Assembly Sensor Switch has water in the hose, replace the entire Main PCB Assembly Board (P/N 190000).

7. Spare Parts List

7.1 Mixing Chamber Components

Part Number	Description
K01-00163-1	Assy, Fitting, QD
170030	Assy, Mixing Chamber
K01-00182-1	Assy, Orifice Plate
170025	Assy, Powder Detector
210037	Block, Retainer
K01-00148-1	Cap, Mixing
K01-00162-1	Gasket, Base
K01-00153-1	Gasket, Base Cap
K01-00154-1	Gasket, Cap Mixing
210082	Gasket, Orifice Plate
480010	Knob, Clamping
K01-00149-1	Nut, Mixing Chamber Cap
K01-00165-1	Nut, QD Thread
K99-00266-3	Vibrator, 115V
K99-00014-2	Washer, Nylon, .14"
320003	Washer, Split Lock, ¼"
320002	Washer, Flat

7.2 Pinch Valve Components

Part Number	Description
K01-00160-1	Body, Pinch Valve
K01-00164-2	Block, Bottom
K01-00037-1	Block, Shoe
K01-00164-1	Block, Top
K01-00155-1	Diaphragm, Pinch Valve
K01-00159-1	Gasket, Retainer
K99-00302-1	O-Ring, Pinch Valve
K99-00305-5	Pin, Dowel
K01-00152-1	Piston, Pinch Valve
K01-00168-1	Screw, Alignment for bottom block
K99-00303-1	Screw, Thumb for top block
K99-00319-3	Tube, Pinch
K01-00325-1	Kit, Pinch Tube

7.3 Remote Control Component

Part Number	Description
180010	Assy, Cable RJ45
190002	Assy, PCA Remote
170024	Assy, Remote Control
960002	Assy, Software, M5 117 RC
960005	Assy, Software, M5 292 RC
210031	Bracket, Handpiece
340001	Clip, Plastic for Handpiece
600030	Connector, RJ45
400000	Spring, Internal
600064	Switch, Float, Safety

7.4 Tubing

Part Number	Description
390001	Tubing, Nylon, 4mm, Black
390000	Tubing, Nylon, ¼" OD, Black
390003	Tubing, Nylon, ¼" OD, Red
K99-00404-1	Tubing, Super Hose, Black
K99-00200-2	Tubing, Urethane, 3/32" ID x 5/32" OD, Clear
K99-00200-1	Tubing, Urethane, 3/32" ID x 5/32" OD, Clear
K99-00200-3	Tubing, Urethane, 1/8" ID x ¼" OD, Clear
K99-00085-1	Tubing, Urethane, ¼" ID x 3/8" OD, Clear
390008	Tubing, .095" ID x .4" OD, Black

7.5 Exhaust Bottle Components

Part Number	Description
210204	Bottle, Exhaust
210017	Bracket, Exhaust Bottle
360017	Fitting, Bushing ¼" MPT x 1/8" FPT
K99-00260-1	Fitting, Pipe, Street Tee, 1/8"
K99-00020-1	Fitting, Pipe Thread, Male, 1/8"
360037	Fitting, Street Elbow, 45°
480031	Bottle, Exhaust (WATTS)
480081	Filter Element, Exhaust Bottle
360025	Fitting, Tee, Plastic
480030	Knob, 10/32"
K99-00221-5	Nut, 10/32"
310020	Screw, 10/32"
K99-00270-4	Washer, #10, Locking

7.6 Filters/Mechanical Pneumatic Components

Part Number	Description
K99-00264-1	Filter, Ambient Dryer
480023	Filter, Coalescing, Transparent
370007	Filter, Muffler, Intake, Jun Air
480007	Filter, Odor Removal

Parts Number	Description
480006	Filter, Oil Removal
K99-00115-1	Regulator, Norgren
K99-00309-1	Regulator, Bracket for Norgren

7.7 Fittings

Part Number	Description
K01-00184-1	Assy, Fitting, Bulkhead, Canister
360002	Fitting, Bulkhead, ¼", QD
K01-00172-1	Assy, Fitting, Nipple, PV
170138	Assy, Fitting, Tee Billet, PV
K99-00256-1	Fitting, Coupler, 10/32" NPT x 3/32" Barb, Brass
K99-00243-1	Fitting, Coupler, 10/32" NPT x 1/8" Barb, Brass
K99-00359-1	Fitting, Coupler, Bulkhead, ¼", QD
360023	Fitting, Coupler, Elbow, ¼" NPT x ¼" Barb Brass
360018	Fitting, Coupler, Elbow, 1/8" NPT x ¼", OD
360027	Fitting, Coupler, Tee, 1/16" Barb, Brass
360029	Fitting, Coupler, Tee, 1/8", QD
360030	Fitting, Union, 1/8" NPT x ¼" Tee, QD
K99-00259-1	Fitting, Union, 10/32" NPT
K99-00277-1	Muffler, 10/32" NPT
K99-00259-1	Valve, Check

7.8 Accessories, Handpieces, Nozzles & Other

Part Number	Description
200002	Assy, Handpiece, Standard
170053	Assy, Handpiece, SS, Red, 45°, .018/46
170059	Assy, Handpiece, SS, Red, 67°, .018/46
170060	Assy, Handpiece, SS, Red, 90°, .018/46
170061	Assy, Handpiece, SS, Gold, 45°, .014/36
170062	Assy, Handpiece, SS, Gold, 67°, .014/36
170063	Assy, Handpiece, SS, Gold, 90°, .014/36
170064	Assy, Handpiece, SS, Violet, 45°, .011/28
170065	Assy, Handpiece, SS, Violet, 67°, .011/28
170066	Assy, Handpiece, SS, Violet, 90°, .011/28
170009-1	Nozzle, Gray, 45°, .011/28
170009-2	Nozzle, Gray, 67°, .011/28
170009-3	Nozzle, Gray, 90°, .011/28
170010-1	Nozzle, Green, 45°, .014/36
170010-2	Nozzle, Green, 67°, .014/36
170010-3	Nozzle, Green, 90°, .014/36
170011-1	Nozzle, Blue, 45°, .018/46
170011-2	Nozzle, Blue, 67°, .018/46
170011-3	Nozzle, Blue, 90°, .018/46
170012-1	Nozzle, Brown, 45°, .026/66
170012-2	Nozzle, Brown, 67°, .026/66
170012-3	Nozzle, Brown, 90°, .026/66
170013-1	Nozzle, Black, 45°, .032/81
170013-2	Nozzle, Black, 67°, .032/81
170013-3	Nozzle, Black, 90°, .032/81

Part Number	Description
K99-00356-1	Block, Leaner Prep
990085	Booklet, Guidelines at a Glance
460018	Booklet, Pocket, for Guidelines at a Glance
140007	Cart, Mach 5.0
170081	Footswitch
600071	Fuse, 10 Amp Slo Blo, Mach 5.0 Plus
600089	Fuse, 1 Amp, Mach 5.0
K99-00002-1	Goggles, (3 Pack)
K01-00181-1	Holder, Handpiece, Mach 4.0
K01-00058-1	Hose, Air Supply, 10'
150002	Kit, Caster, Mach 5.0
170068	Kit, Chair Integration
K99-00116-1	Oil, JunAir, 20 oz.
K01-00301-1	Pinch Tubes
140008	Powder, Gamma Pure, 27.5 micron, gray
140013	Powder, 27 micron, white
140014	Powder, 34 micron, white
140012	Powder, 50 micron, white
600105	Power Cord, 115VAC
990069	Manual, Clinical Guidelines
990008	Manual, Operators, Mach 5.0 and 5.0 Plus
120000	Vapor Trap, Cart Mount
K01-00209-1	Vapor Trap, Wall Mount
130045	Video, Instructional Air Abrasion

7.9 Adhesives

Part Number	Description
K99-00310-1	Locktight, 292, Threaded Connections
450000	Locktight, 680, Permanent Connection
460015	Lubricant, Superlube
K99-00297-1	Pneumatic Sealant, High Pressure Connections
450008	Seal, Torque, Anti-Sabotage Inspectors
K99-00271-1	Tie Cable, Wire Holder
K99-00100-1	Tie Cable, Small
K99-00100-2	Tie Cable, Large

7.10 Chassis Components

Part Number	Description
210087	Bracket, Caster, Large Swivel
480028	Caster, Large Swivel
480008	Caster, Small Rigid
480009	Caster, Small Swivel
210106	Door, L/R, Mach 5.0 Plus
210105	Door, R, Mach 5.0
210104	Door, L, Mach 5.0
480036	Door Latch
210024	Drawer
210067	Handle, Hose
210061	Hinge, Steel

Part Number	Description
210134	Hinge Spacer for Steel
210034	Hinge, Plastic
480021	Key, Door Lock
210050	Pad, Drawer
210086	Skirt
210023	Top, Molded

7.11 Electrical/Electrical Components

Part Number	Description
190000	Assy, Main PCA
590001	Assy, Power Supply
960005	Assy, Software, 292 MC
190006	Assy, Vibrator Interface PCA
600089	Fuse, Mach 5.0
600071	Fuse, Mach 5.0 Plus
600097	Fuse, Vibrator PCA
K99-00234-1	IC, UDN2540B, Driver
600008	Module, Power Entry
600087	Resonator, 3.58
600007	Sensor, Pressure
350004	Solenoid Valve, Main Air
K99-00238-1	Solenoid Valve, Pinch Valve
K99-00199-2	Switch, Air
600077	Trim Pot, 500 ohms

7.12 Maintenance Kits

Part Number	Description
150021	Kit, Burp Enhancement
150022	Kit, Exhaust Bottle Upgrade
150027	Kit, "Y" Piece Replacement
150028	Kit, Pinch Valve Maintenance
140046	Kit, Year Maintenance, Mach 5.0
140047	Kit, Year Maintenance, Mach 4.0 and 4.1
140048	Kit, Year Maintenance, Silent Air, Mach 5.0 Plus
140049	Kit, Year Maintenance, JunAir, Mach 5.0 Plus

8. Schematics and Diagrams

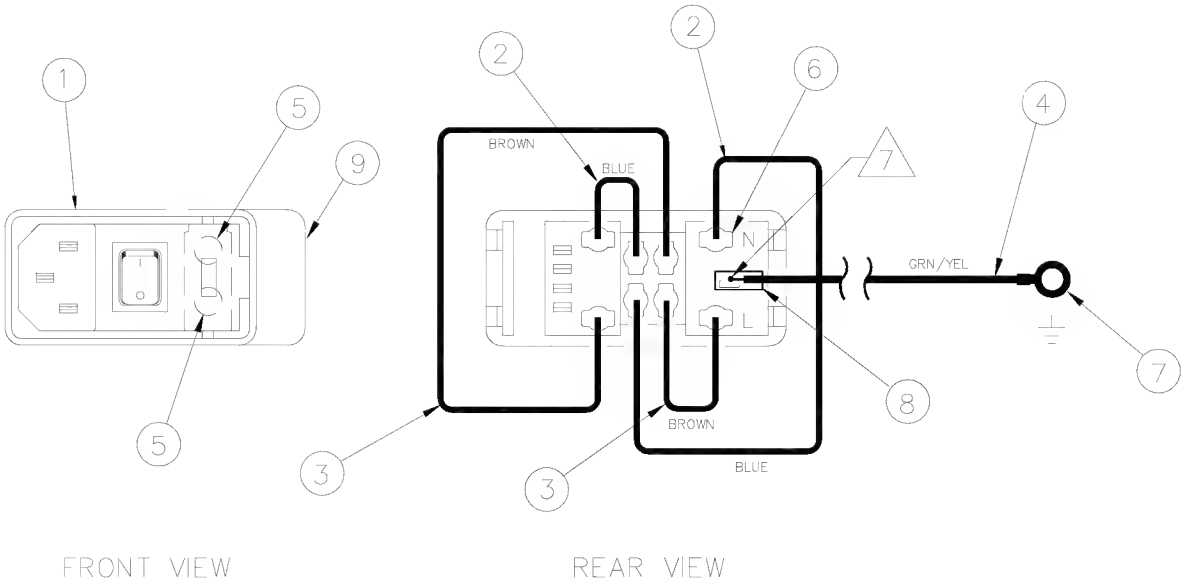


Figure 30 Power Entry (180008)

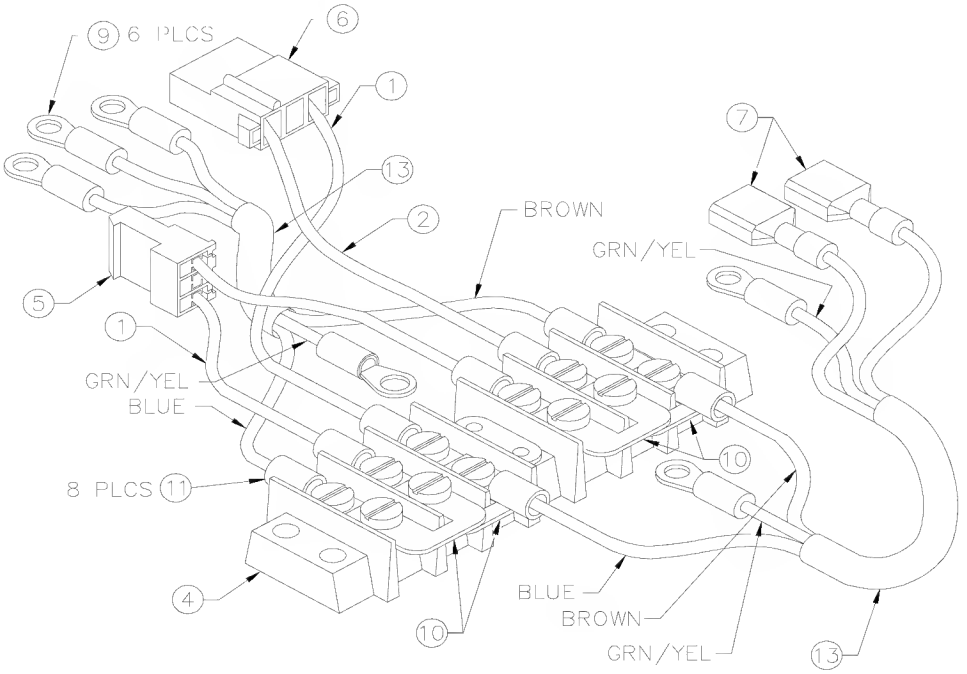


Figure 31 Terminal Strip Layout (970025)

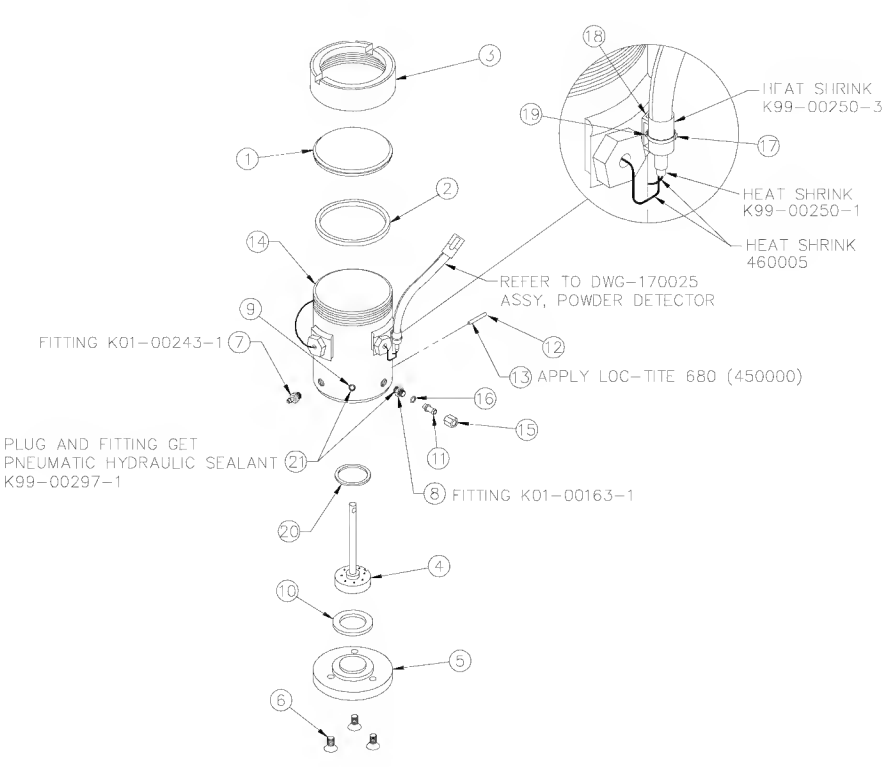


Figure 32 Canister Assembly (170030)

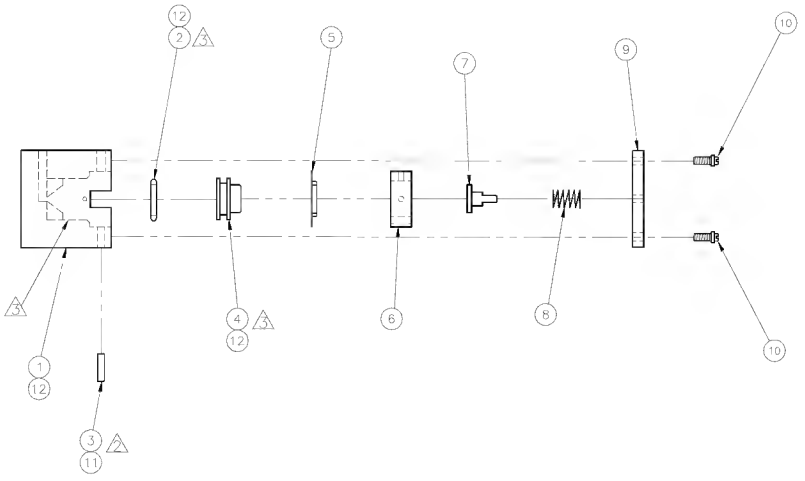


Figure 33 Pinch Valve Assembly (K01-00185-1)

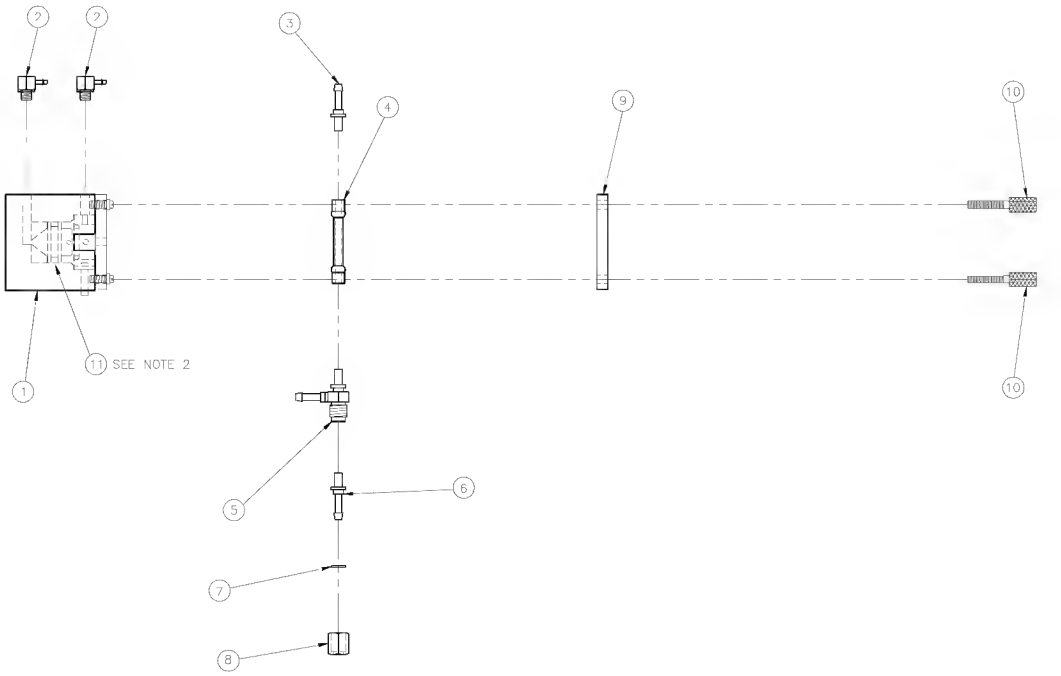


Figure 34 Abrasive Pinch Valve Assembly (K01-00210-1)

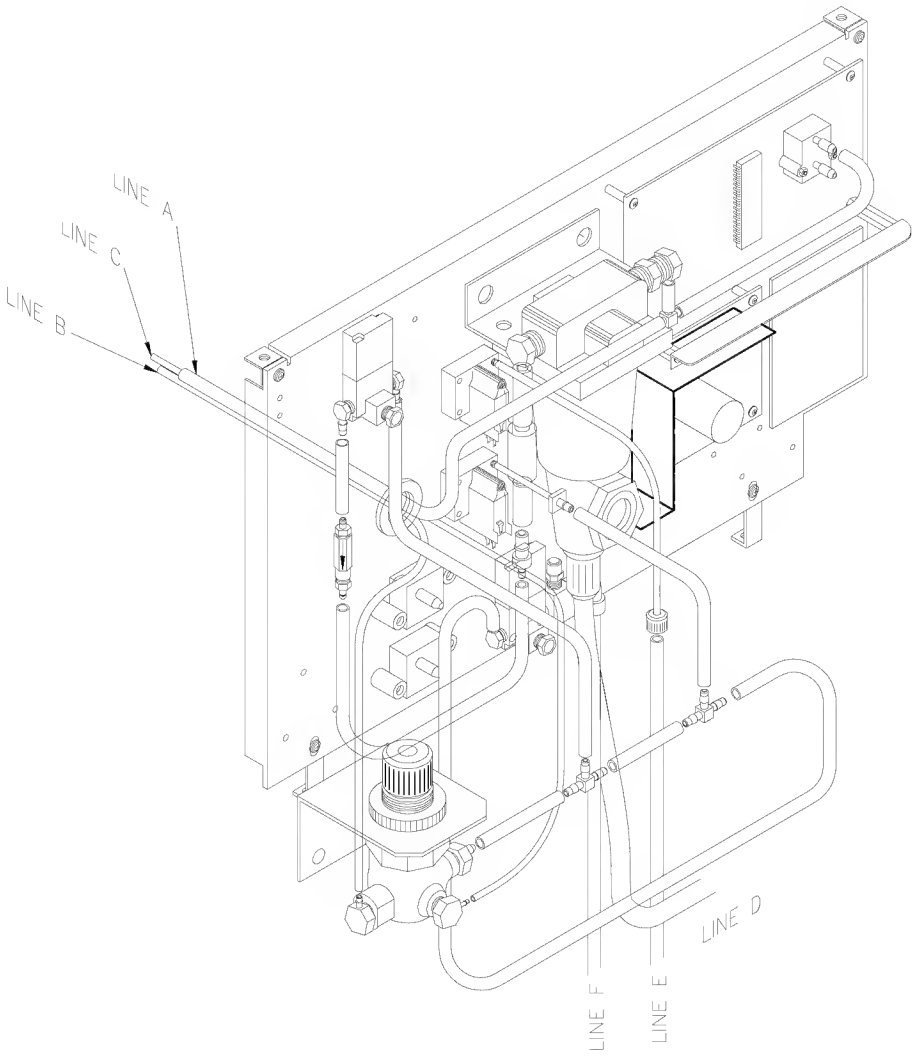


Figure 35 Pneumatic Diagram

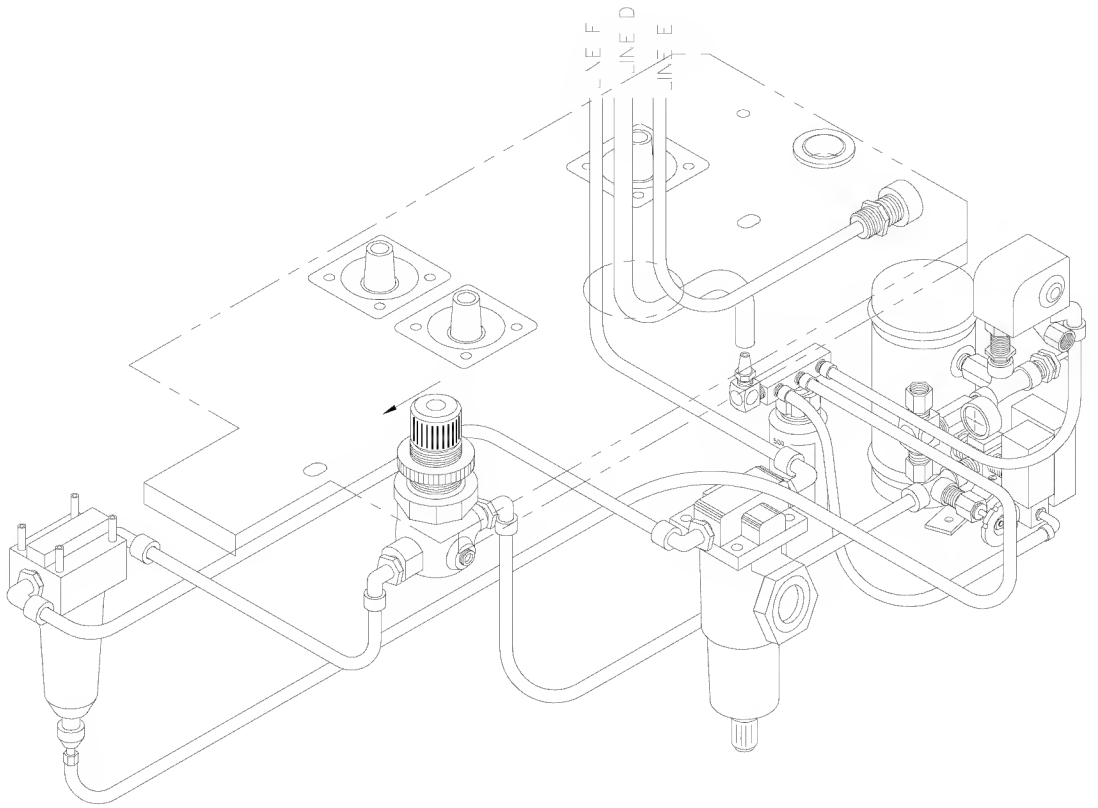


Figure 36 Pneumatics Diagram

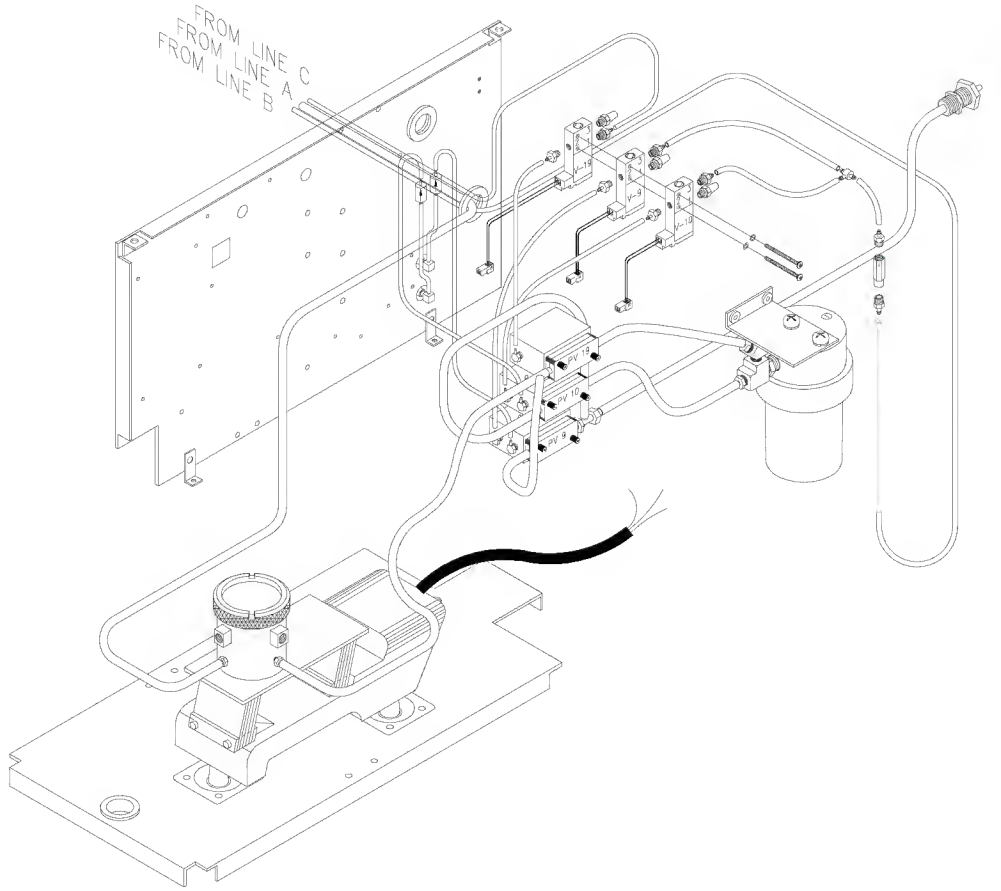


Figure 37 Pneumatics Diagram

9. Warranty, Returns and Adjustments

9.1 Returns and Adjustments

Warranty claims must be made promptly and received by your nearest authorized service representative during the warranty period. The liability of Kreativ, Inc., under valid warranty claims, is limited to repair or replacement at the purchaser's authorized service center or the purchaser's place of business, at the option of the authorized service representative. If it is necessary to return a product for repair or replacement, authorization for the return must first be obtained from the authorized service representative.

All products returned for examination or warranty repair must be sent insured via a means of transportation specified by the authorized service representative.

Kreativ, Inc., or its authorized service representative claims the sole responsibility for determining the cause of any instrument failure.

9.2 Limited Warranty

Kreativ, Inc., warrants the equipment to be free from defects in material and workmanship for a period of 12 months from the date of shipment. Damage due to failure of customer to perform required user/preventative maintenance is not warranted. Certain components having limited life expectancy (bulbs, handpieces, and liquid light guides) are not warranteed against normal wear and tear or customer damage. This limited warranty applies only to the original purchaser/user of the equipment.

The foregoing limited warranty is exclusive and in lieu of all other warranties, whether written, oral, or implied, and shall be purchaser's sole remedy and Kreativ's sole liability under contract or warranty or otherwise for the product.

Kreativ, Inc., disclaims any implied warranty of merchantability or fitness for particular purposes. In no event shall Kreativ, Inc., be liable for any incidental or consequential damages, or for any incidental or consequential damages arising out of, or in connection with, the use or performance of the product delivered hereunder.

9.3 Storage And Shipment

The Kreativ Model Mach 5.0 and Mach 5.0 PLUS have been designed for long term storage in normal dental office environments. If it is to be stored for any reason for a long period, it should be covered to protect it from adverse conditions and the Powder Canister should be emptied. The area it is to be stored in should meet the Environmental Limitations Transport and Storage Requirements indicated in Section 2.4, "System Specifications".

The unit has been designed for shipment by normal commercial carriers. Protective packaging should be used, and the original packing materials should be reinstalled for shipment. Shipping instructions must be followed closely. The customer will be responsible for damage resulting from improper packing.